SOIL SURVEY OF

Wichita County, Texas

United States Department of Agriculture
Soil Conservation Service

In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1967-72. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Wichita Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures ; and in judging the suitability of tracts of land for farming, industry and recreation.

Locating Soils

All the soils of Wichita County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The “Guide to Mapping Units” can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many purposes can be developed by using the soil map and the information in the text. Translucent material can be laid over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about management of the soils from the soil descriptions and from the discussions of the capability units and the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section “Wildlife.”

Ranchers and others can find, under “Range,” groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, for industrial buildings, and for recreation areas in the sections “Engineering Uses of Soils” and “Recreation.”

Engineers and builders can find, under “Engineering Uses of Soils,” tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section “Formation and Classification of the Soils.”

Newcomers in Wichita County will be especially interested in the section “General Soil Map,” where broad patterns of soils are described. They will also be interested in the information about the county given at the beginning of this publication.

Cover: Irrigated improved bermudagrass pasture on an area of Deandale silt loam, loamy substratum, 0 to 1 percent slopes.

Contents

Issued May 1977

SOIL SURVEY OF WICHITA COUNTY, TEXAS

BY WAYNE E. RICHARDSON, AULINE R. GOERDEL, AND K. T. LOFTON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH TEXAS
AGRICULTURAL EXPERIMENT STATION

WICHITA COUNTY is in the northernmost part of Texas (fig. 1). The total area of the county is about 392,960 acres, or 614 square miles.

Most of Wichita County is in the eastern part of the Central Rolling Red Plains land resource area of Texas, but the extreme southeast corner is in the Central Rolling Red Prairies land resource area. It consists of smooth, rolling plains that have rounded slopes and shallow, comparatively broad valleys. Elevation of the county ranges from about 900 to 1,200 feet above sea level.

Wichita Falls is the largest city and the county seat. It is an important commercial center that has many petroleum-based firms and plants, as well as hospitals, Sheppard Air Force Base, and Midwestern University. Burkburnett, Iowa Park, and Electra are the other principal towns.

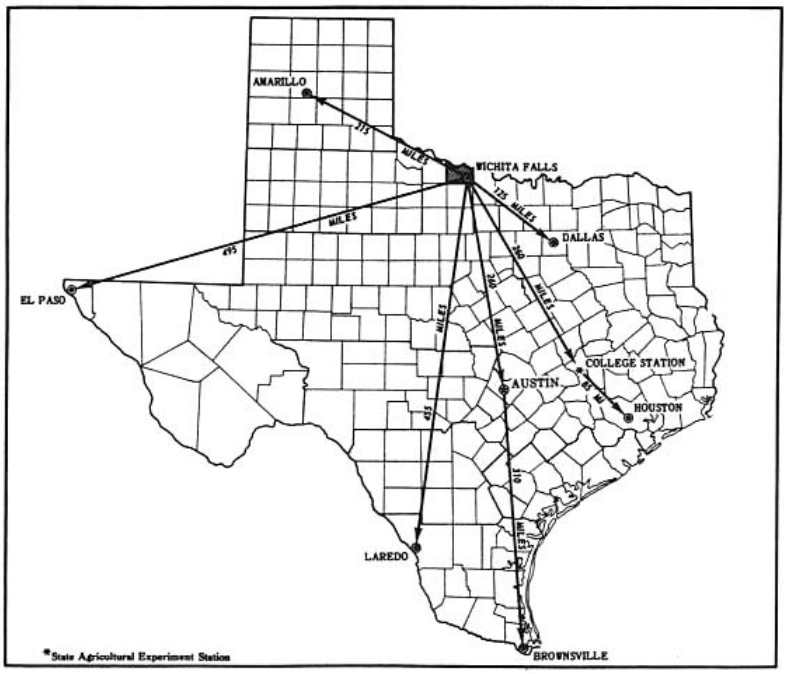


Figure 1.—Location of Wichita County in Texas.

Wichita County has an urbanized economy and is an important oil-producing area. Farming is also important to the economy. About 151,000 acres of the total land area of the county is cultivated. An estimated 11,000 acres of cultivated land is irrigated, and about 9,000 acres is irrigated pasture.

Wheat is the major dryland crop, and wheat, bermudagrass, and alfalfa are the major irrigated crops. About 190,000 acres is in range. Beef-cattle production is the main livestock enterprise. The remaining 42,960 acres consists of rivers, lakes, highways, and urban land.

Drainage in the county is mainly from west to east. The valley of the Red River, extending across the northern part of the county, and the valley of the Wichita River, extending across the southern part, approach each other toward the east and join a few miles east of the northeast corner of the county. Small interior tributary valleys join these main valleys.

Wichita County is the only county in the Wichita Soil and Water Conservation District.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Wichita County, where they are located, and how they can be used. The soil scientists went into the county knowing that they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and various facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for a difference in the texture of the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Kamay and Bluegrove, for example, are the names of two soil series. All the soils in the United

States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects their use by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Kamay silt loam, 1 to 3 percent slopes, is one of several phases within the Kamay series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of other soils that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Wichita County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, joined by a hyphen. Latom-Owens complex, 5 to 20 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purposes of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by “and.” Vernon and Owens soils, 3 to 8 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Oil wasteland is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on crop yields under defined management practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management practices are then estimated for all the soils of that type.

Soil scientists observe how soils behave when used for growing native and cultivated plants, and as material, foundations, or covering for structures. They relate this behavior to specific properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, pavements, and foundations for houses are cracked on a particular kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Wichita County. A soil association is a landscape that has a distinctive proportional pattern of soils. It generally consists of one or more major soils and at least one minor soil, and it is named for the major soils. Soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The six soil associations in Wichita County are described in the following pages.

1. Kamay-Bluegrove-Deandale association

Nearly level to gently sloping, deep and moderately deep, very slowly permeable to moderately slowly permeable soils; on uplands

This association consists of loamy soils that formed in red-bed clay, shale, or sandstone, or in old alluvium derived from red-bed clay and shale. The area is characterized by small ridges and knobs scattered on broad upland plains that have a well-defined drainage pattern of small creeks and tributaries (fig. 2).

This association makes up about 38 percent of the county. It is about 32 percent Kamay soils, 12 percent Bluegrove soils, 10 percent Deandale soils, and 46 percent less extensive soils.

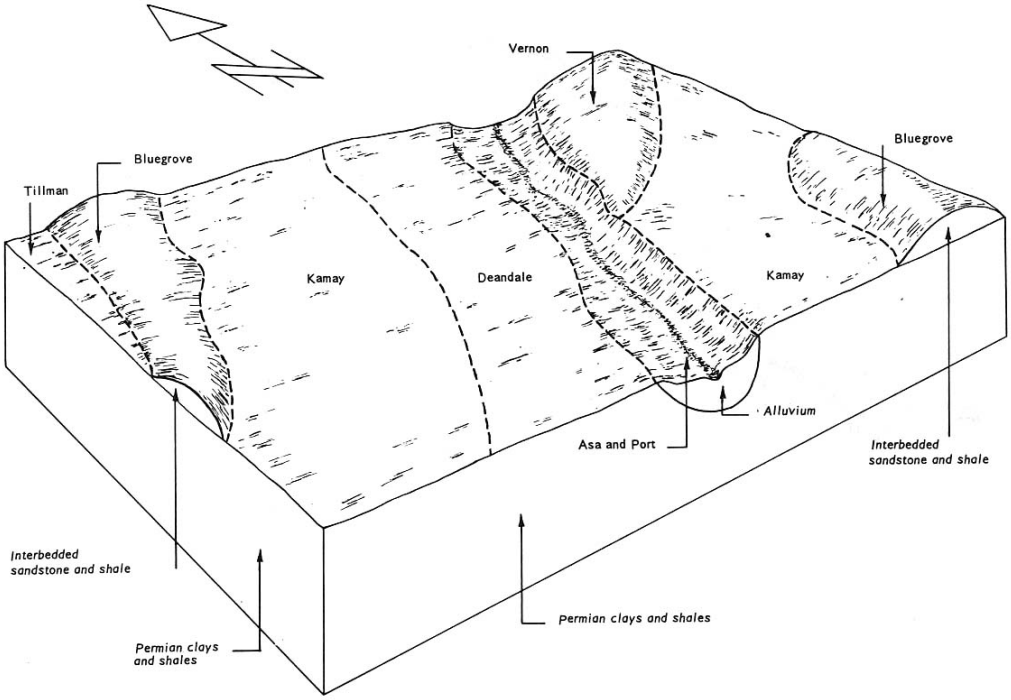


Figure 2.—Pattern of the soils in the Kamay-Bluegrove-Deandale association.

Kamay soils are deep. The surface layer is 10 inches of dark grayish-brown silt loam over very slowly permeable clay.

Bluegrove soils are moderately deep over sandstone. The surface layer is brown loam over moderately slowly permeable clay loam. Bluegrove soils are on ridges and knobs.

Deandale soils are deep. The surface layer is 12 inches of dark grayish-brown silt loam over very slowly permeable clay.

Among the less extensive soils in this association are Tillman, Hollister, Vernon, Frankirk, Renfrow, Asa, and Port soils. Tillman, Hollister, and Frankirk soils are deep and occupy positions on the landscape that are similar to those of Kamay and Deandale soils. Vernon soils are moderately deep and are on some of the sloping areas along drainageways. Asa and Port soils are throughout the association in narrow drainageways.

The hazard of soil blowing is slight on the soils in this association, and the hazard of water erosion is moderate.

About 30 percent of the acreage of this association is cultivated, but only a small acreage is irrigated. Wheat is the principal crop. The soils are droughty and are better suited to small grain than to summer row crops. Although some of the soils are not cultivated, they are suitable for cultivation. The soils in this association are not suited to irrigation with the quality of water available.

2. Tillman-Vernon association

Nearly level to sloping, deep and moderately deep, slowly permeable and very slowly permeable soils; on uplands

This association consists of loamy soils that formed in red-bed clay and shale or in old alluvium derived from red-bed clay and shale. The topography is broken at intervals by drainageways and creeks and rough, gullied, and broken areas (fig. 3).

This association makes up about 20 percent of the county. It is about 54 percent Tillman soils, 22 percent Vernon soils, and 24 percent less extensive soils. Areas of Oil wasteland are also in this association.

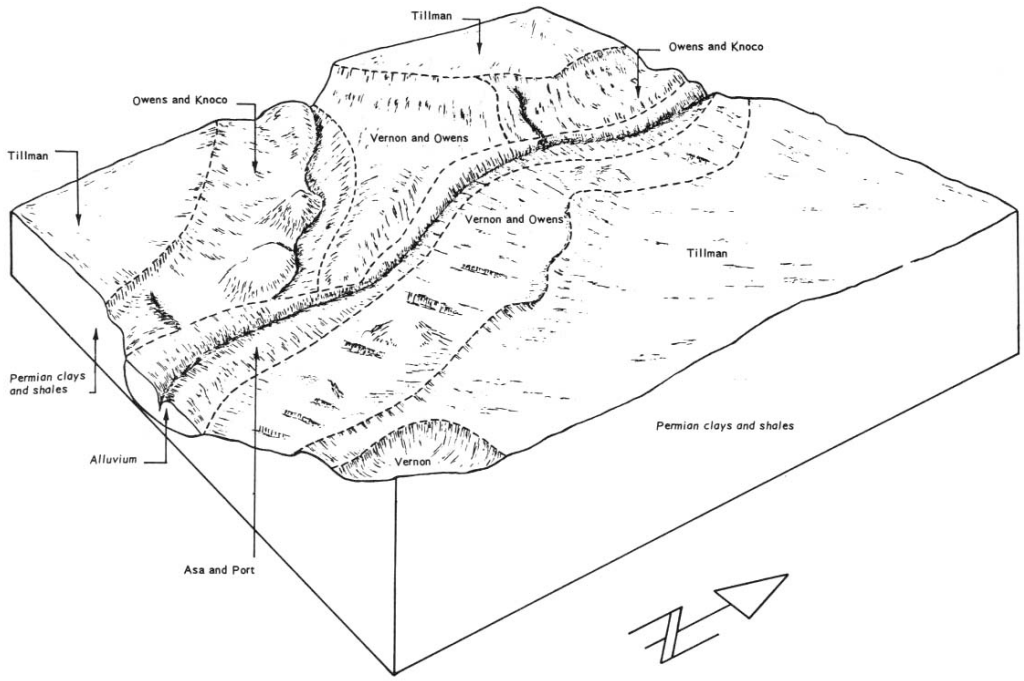


Figure 3.—Pattern of soils in the Tillman-Vernon association.

Tillman soils are deep. The surface layer is 7 inches of reddish-brown clay loam over slowly permeable clay.

Vernon soils are moderately deep. The surface layer is 7 inches of reddish-brown clay loam over very slowly permeable clay.

Among the less extensive soils in this association are Owens, Knoco, Kamay, Cobb, Oben, Asa, and Port soils. Owens and Knoco soils are shallow and very shallow over clay and shale and are in the rough, gullied, and steeper areas. Kamay soils are deep, and they occupy positions on the landscape that are similar to those of Tillman soils. Cobb and Oben soils are moderately deep and shallow over sandstone and are on ridges and knobs. Asa and Port soils are in narrow drainageways throughout the association.

The hazard of soil blowing is slight on the soils in this association, and the hazard of water erosion is moderate to severe.

About 10 percent of the acreage of this association is cultivated. Most of the acreage of Tillman soils is suitable for cultivation. Wheat is the principal crop. The soils in the association are droughty and are better suited to small grain than to summer row crops. The soils are not suited to irrigation with the quality of water available.

3. Clairemont-Mangum association

Nearly level to steep, deep, moderately permeable to very slowly permeable soils; on bottom lands

This association consists of loamy and clayey soils that formed in calcareous, loamy and clayey alluvial sediment. It is on nearly level flood plains along the Wichita River and a few of the larger creeks.

This association makes up about 12 percent of the county. It is about 33 percent Clairemont soils, 28 percent Mangum soils, and 39 percent less extensive soils.

Clairemont soils are deep. The surface layer is 7 inches of light reddish-brown silt loam over moderately permeable silt loam and silty clay loam that has strata of very fine sandy loam.

Mangum soils are deep. The surface layer is 7 inches of reddish-brown silty clay loam over very slowly permeable clay that contains thin strata of silty clay loam.

Among the less extensive soils in this association are Yomont, Yahola, Asa, and Port soils. Yomont and Yahola soils are mostly in low areas adjacent to rivers or creeks. Asa and Port soils are along the smaller creeks.

The hazard of soil blowing is slight on these soils, and the hazard of water erosion is slight to severe. Soils in this association are subject to flooding.

About 50 percent of the acreage of this association is cultivated. About 30 percent of the cultivated acreage is irrigated. Bermudagrass, small grain, cotton, forage sorghum, and alfalfa are the major crops. The soils in this association are suited to irrigation.

4. Motley-Frankirk association

Nearly level to gently sloping, deep, moderately permeable and moderately slowly permeable soils; on uplands

This association consists of loamy soils that formed in loamy, old alluvial sediment. It is on broad upland plains dissected at wide intervals by small drainageways and creeks.

This association makes up about 11 percent of the county. It is about 30 percent Motley soils, 22 percent Frankirk soils, and 48 percent less extensive soils.

Motley soils are deep. The surface layer is 9 inches of brown loam over moderately permeable sandy clay loam.

Frankirk soils are deep. The surface layer is 7 inches of brown loam over moderately slowly permeable clay loam and clay.

Among the less extensive soils in this association are Rotan, Tipton, Kamay, Winters, and Bluegrove soils. Rotan and Tipton soils are deep and are on broad, less sloping areas. Kamay and Winters soils are deep, and they occupy positions on the landscape that are similar to those of Frankirk soils. Bluegrove soils are moderately deep over sandstone and are on ridges and knobs.

The hazard of soil blowing is slight on the soils in this association, and the hazard of water erosion is slight to moderate.

About 70 percent of the acreage of this association is cultivated. Wheat, cotton, winter peas, grain sorghum, and alfalfa are the main crops.

5. Enterprise association

Nearly level to moderately steep, deep, moderately rapidly permeable soils; on uplands

This association consists of loamy soils that formed in loamy eolian material blown from the channels of nearby streams. It is level to gently sloping on plains. Areas of this association are sloping and moderately steep and are on breaks or scarps between upland plains and flood plains of the Red River (fig. 4).

This association makes up about 10 percent of the county. It is about 54 percent Enterprise soils and 46 percent less extensive soils.

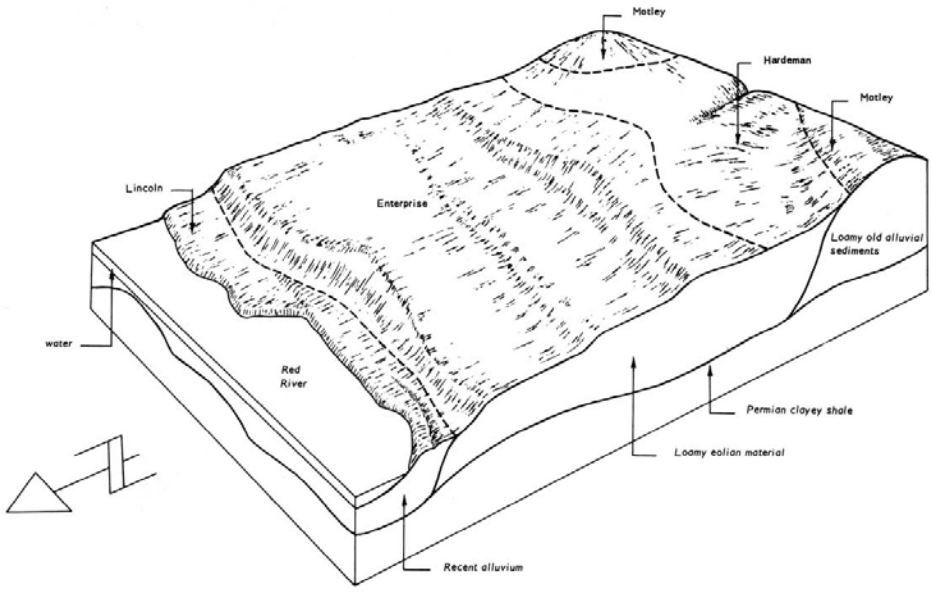


Figure 4.—Pattern of the soils in the Enterprise association.

Enterprise soils are deep. The surface layer is 20 inches of reddish-brown very fine sandy loam over moderately rapidly permeable very fine sandy loam.

Among the less extensive soils in this association are Lincoln, Hardeman, Tivoli, Motley, Tipton, Asa, and Port soils. Hardeman, Motley, and Tipton soils are deep and they occupy positions on the landscape that are similar to those of Enterprise soils. Tivoli soils are deep and occur as dunes on flood plains. Lincoln soils are deep and are also on flood plains. Asa and Port soils are mostly on flood plains along creeks that drain into the Red River.

The hazard of soil blowing is slight on the soils in this association. The hazard of water erosion is slight to moderate on the less sloping areas and severe on the steeper areas.

About 60 percent of the acreage in this association is cultivated. Wheat, cotton, alfalfa, and oats are the principal crops.

6. Winters-Deandale association

Nearly level to gently sloping, deep, moderately slowly permeable to very slowly permeable soils; on uplands

This association consists of loamy soils that formed in old stream alluvium partly derived from red-bed clay and shale. It is on old outwash plains along major drainageways.

This association makes up about 9 percent of the county. It is about 52 percent Winters soils; 36 percent Deandale, loamy substratum, soils; and 12 percent less extensive soils.

Winters soils are deep. The surface layer is 7 inches of reddish-brown loam over moderately slowly permeable clay.

Deandale soils are deep. The surface layer is 12 inches of dark grayish-brown silt loam over very slowly permeable clay.

Among the less extensive soils in this association are Mangum, Clairemont, and Kamay soils. Mangum and Clairemont soils are deep and are on the lower part of flood plains along creeks. Kamay soils are deep and are mainly along the edge of this association.

The hazard of soil blowing is slight on the soils in this association, and the hazard of water erosion is slight to moderate.

Most of the acreage of this association is cultivated, and about 40 percent is irrigated. Bermudagrass, small grain, cotton, and forage sorghum are the major crops.

Descriptions of the Soils

United States Department of Agriculture. Soil survey manual, USDA Handb. No. 18,503 pp. illus., 1951.

In this section the soils of Wichita County are described in detail, and their use and management are discussed. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile different in some ways from the one described in the series, these differences are stated in the description of the mapping unit, or are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

As mentioned in the section “How This Survey Was Made,” not all mapping units are members of a soil series. Oil wasteland, for example, does not belong to a soil series but, nevertheless, is listed in alphabetic order along with the series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be learned by referring to the “Guide to Mapping Units” at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils are defined in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.

Asa Series

The Asa series consists of deep, nearly level, loamy soils on bottom lands. The soils formed in calcareous, stratified loamy and silty alluvium.

In a representative profile the surface layer is brown silty clay loam about 8 inches thick. Below is 10 inches of reddish-brown, firm silty clay loam over 22 inches of reddish-brown friable silt loam. The underlying material is 20 inches or more of reddish-brown silt loam that has strata of silty clay loam.

These soils are well drained and moderately permeable. Runoff is slow, and available water capacity is high.

Representative profile of Asa silty clay loam, occasionally flooded, 2.2 miles east of Electra, Texas, via U.S. Highway 287 Business, then 0.2 mile south on county road and 50 feet west, in an area of range:

A1—0 to 8 inches, brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, firm; many roots; many fine pores; many worm casts; mildly alkaline; gradual, smooth boundary.

B21—8 to 18 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate, fine, subangular blocky structure; hard, firm; many fine pores; many worm casts; few spots of calcareous material; noncalcareous; moderately alkaline; clear, smooth boundary.

B22—18 to 40 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; slightly hard, friable; few calcium carbonate concretions; calcareous, moderately alkaline.

C—40 to 60 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable; contains strata of silty clay loam; calcareous; moderately alkaline.

The A horizon ranges from 5 to 15 inches in thickness. It is silty clay loam, clay loam, silt loam, or loam that is reddish-brown, brown, or dark brown. It is mildly alkaline or moderately alkaline.

The B horizon is silty clay loam to silt loam that is dark reddish brown, reddish brown, brown, or dark brown. It is 8 to 35 inches thick. Depth to calcareous material ranges from 15 to 36 inches.

The C horizon is silty clay loam, silt loam, or clay loam that is reddish brown or yellowish red and is stratified.

The Asa soils in Wichita County are drier for longer periods than is typical for the series, but this difference does not affect their use, management, or behavior.

Asa silty clay loam, occasionally flooded (As).—This soil is on flood plains along the creeks and smaller streams of the county. It has the profile described as representative of the series. Most areas are long and narrow and almost parallel to the stream channel. Areas range from 10 to several hundred acres in size. Slopes range from about 0.3 to 1 percent.

Included with this soil in mapping are some areas of Port and Clairemont soils. Also included are areas of soils that do not have a dark-colored surface layer. Some areas of soils that have a dark-colored surface layer thicker than 20 inches are included.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Asa soil is used as range. Drainageways along the creeks and streams are not large enough to carry large flows of water, and the areas are subject to flooding every 2 years or once in 5 to 10 years. If this soil is cultivated, conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. Capability unit IIw-3, dryland; Draw range site.

Asa and Port soils, frequently flooded (Aw).—This mapping unit is on flood plains along creeks and small intermittent streams. Areas range from 100 feet to several hundred feet wide and are as much as several miles long. They are dissected by shallow to moderately deep channels that meander back and forth within the flood plain.

The Asa soils are in most areas, but the Port soils are not. On an average, Asa soils make up 40 percent of the mapping unit, Port soils 20 percent, and other soils 40 percent. The range in percentage composition is Asa soils, 10 to 65 percent; Port soils, 0 to 60 percent; and other soils, 25 to 60 percent.

The Asa soils have a surface layer of dark-brown silt loam about 14 inches thick. Below is about 35 inches of reddish-brown silty clay loam that is calcareous at a depth of 32 inches. The underlying material is reddish-brown silt loam that contains strata of silty clay loam.

The Port soils have a surface layer of grayish-brown silt loam about 21 inches thick. Below is about 50 inches of reddish-brown, firm silty clay loam that is calcareous at a depth of 22 inches.

Included with these soils in mapping are areas of Clairemont, Yahola, Yomont, and Mangum soils. Also included are soils that are similar to Asa soils, but their surface layer is not so dark as that of Asa soils.

This unit is subject to frequent flooding during rainy periods. However, the water quickly recedes and causes little damage to permanent vegetation, but cultivated crops are likely to be damaged.

Most of the acreage of these soils is used as range. These soils are not well suited to cultivation because of susceptibility to frequent flooding. Areas of these soils are likely to flood more than once each year. These bottom land areas are suitable for use as range, wildlife habitat, and some recreational sites. Proper grazing practices and control of brush are needed. Capability unit Vw-1, dryland; Loamy Bottomland range site.

Bluegrove Series

The Bluegrove series consists of moderately deep, gently sloping, loamy soils on uplands. The soils formed in interbedded sandstone and shale.

In a representative profile the surface layer is brown loam about 8 inches thick. Below this layer is 26 inches of reddish-brown, firm clay loam. The underlying material is 30 inches or more of light-gray, weakly cemented sandstone (fig. 5).

These soils are well drained and moderately slowly permeable. Runoff is medium, and available water capacity is medium.

Representative profile of Bluegrove loam, 1 to 3 percent slopes, at the southeast edge of Wichita Falls, 900 feet south and 1,000 feet west of the intersection of Windthorst Road and the south access road of U.S. Highway 287:

A1—0 to 8 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, medium, granular structure; slightly hard, very friable; slightly sticky, slightly plastic; slightly acid; abrupt, smooth boundary.

B21t—8 to 24 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine and medium, subangular blocky structure; hard, firm; sticky, plastic; many very fine pores; common iron and manganese concretions; few worm casts; thin, continuous clay films on surfaces of peds; slightly acid; gradual, irregular boundary.

B22t—24 to 34 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate, fine and medium, subangular blocky structure; hard, firm; sticky, plastic; common fine pores; few, faint, yellowish mottles; common iron and manganese concretions; few worm casts; thin, patchy clay films; few fine sandstone fragments; neutral; clear, irregular boundary.

C—34 to 64 inches, light-gray (2.5Y 7/2), weakly cemented sandstone.

Depth to sandstone ranges from 20 to 40 inches.

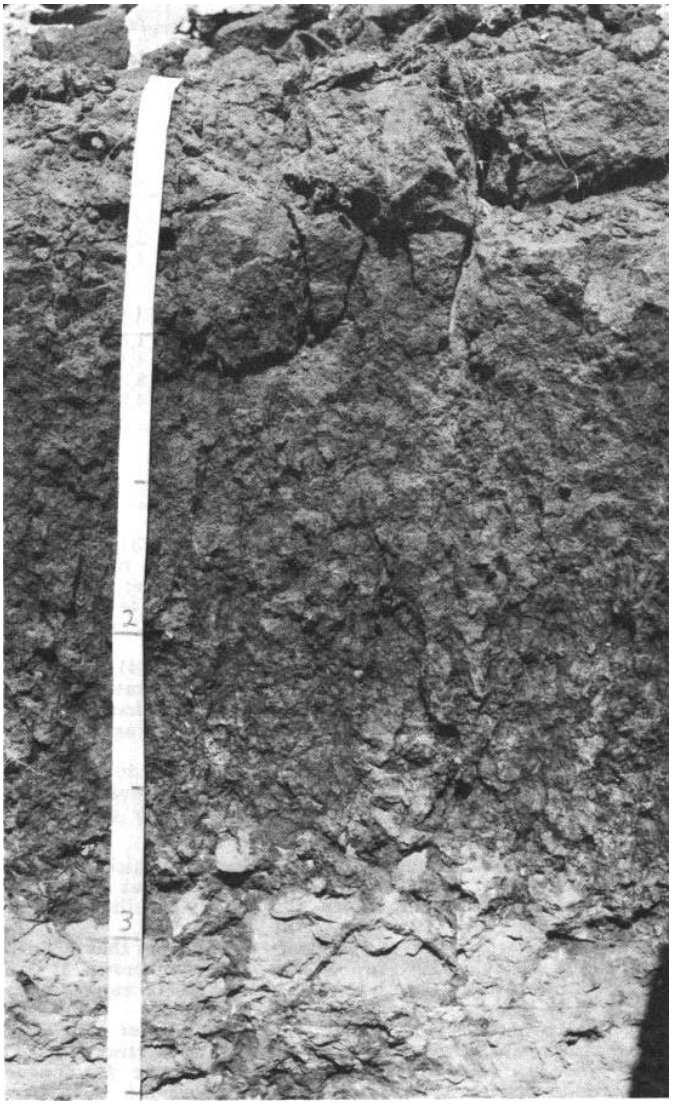


Figure 5.—Profile of a Bluegrove loam. Weakly cemented sandstone is at a depth of about 34 inches.

The A horizon is reddish brown, brown, or dark brown and is 5 to 10 inches thick. It is medium acid to neutral.

The B2t horizon is clay loam to clay that is reddish brown, yellowish red, or red. It is medium acid to mildly alkaline.

The C horizon is fractured sandstone that is interbedded with clay and clayey shale. It ranges from weakly consolidated to strongly cemented.

Bluegrove loam, 1 to 3 percent slopes (BeB).—This gently sloping soil is on upland areas that have a convex surface. It has the profile described as representative of the series. Areas are mostly on low ridges and are elongated. They range from 5 to about 300 acres in size. Most are less than 75 acres. Slopes are dominantly about 2 percent.

Included with this soil in mapping are areas of Oben, Cobb, and Kamay soils and small areas of Vernon soils.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate

on this soil.

About 75 percent of the acreage of this Bluegrove soil is cultivated. Small grain is the major crop. Crop rotation, leaving crop residue on or near the surface, and limited but timely tillage are good management practices. Contour cultivation, along with the use of terraces, is needed for control of water erosion. Capability unit IIe-2, dryland; Tight Sandy Loam range site.

Bluegrove loam, 3 to 5 percent slopes (BeC).—This gently sloping soil is on upland areas that have a convex surface. Areas are on ridges and knobs. They range from 5 to about 150 acres in size. Most are less than 50 acres in size. Slopes are dominantly about 4.5 percent.

The surface layer is reddish-brown loam about 6 inches thick. Below this layer is about 18 inches of reddish-brown, firm clay loam. The underlying material is interbedded light-gray, weakly cemented sandstone and red, clayey shale.

Included with this soil in mapping are areas of Cobb and Vernon soils. A few small spots of Oben soils and sandstone outcrops are also included.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

Most of the acreage of this Bluegrove soil is used as range. Small grain is the main crop when this soil is cultivated. Leaving crop residue on or near the surface helps to prevent erosion. Timely but limited tillage and contour farming, along with the use of terraces, are good management practices. This soil responds to applications of fertilizer. Capability unit IIIe-3, dryland; Tight Sandy Loam range site.

Bluegrove-Urban land complex, 1 to 3 percent slopes (BuB).—This mapping unit is scattered throughout built-up areas in the city of Wichita Falls. It is on convex ridges and knobs. Areas range from 55 to 118 acres in size.

About 30 percent of this unit is Bluegrove soils, 60 percent is Urban land, and 10 percent is other soils. The areas of the soils are too small and too intermingled to be separated at the scale mapped.

The Bluegrove soils have a surface layer of reddish-brown loam about 7 inches thick. Below this layer is about 22 inches of reddish-brown, firm clay loam. The underlying material is light-gray, weakly cemented sandstone.

Urban land consists of works and structures, mostly houses, commercial buildings, streets, driveways, parking lots, and sidewalks.

Included with this complex in mapping are areas of Oben, Vernon, and Kamay soils.

Among the limitations to use of this complex for urban development are shrink-swell, which causes cracking and shifting of structures, and permeability and depth to sandstone, which contribute to failure of septic tank filter fields and seepage from sewage lagoons. Not assigned to a capability unit or to a range site.

Clairemont Series

The Clairemont series consists of deep, nearly level, loamy soils on bottom lands. The soils formed in calcareous, loamy, recent alluvium.

In a representative profile the surface layer is light reddish-brown silt loam about 7 inches thick. The underlying material, to a depth of 90 inches, is silt loam and silty clay loam that contains strata of very fine sandy loam. The upper 19 inches is light reddish brown, the middle 30 inches is reddish brown, and the lower 34 inches is light reddish brown.

These soils are well drained and moderately permeable. Runoff is slow, and available water capacity is high. The wet phase is somewhat poorly drained and has medium available water capacity.

Representative profile of Clairemont silt loam, 0.5 mile east via Farm Road 367 from its intersection with Farm Road 368, then 1 mile south and 30 feet east of fence, in a cultivated field, about 2.8 miles south of Iowa Park:

Ap—0 to 7 inches, light reddish-brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; weak, fine, granular structure; slightly hard, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

C1—7 to 26 inches, light reddish-brown (2.5YR 6/4) stratified silt loam and very fine sandy loam, reddish brown (2.5YR 5/4) moist; massive, parting to blocky fragments that have dull faces; slightly hard, very friable; bedding planes are partly destroyed but are observable; few fine pores and many very fine pores; few worm casts; calcareous; moderately alkaline; abrupt, smooth boundary.

C2—26 to 56 inches, reddish-brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; contains strata of light reddish-brown (2.5YR 6/4) silt loam and very fine sandy loam; massive, parting to granular fragments that have dull faces; weak bedding planes are observable; calcareous; moderately alkaline; diffuse, smooth boundary.

C3—56 to 90 inches, light reddish-brown (2.5YR 6/4) stratified silt loam and very fine sandy loam, reddish brown (2.5YR 5/4) moist; massive, parting to granular fragments that have dull faces; slightly hard, very friable; calcareous; moderately alkaline.

The A horizon ranges from 5 to 14 inches in thickness. It is silt loam, clay loam, and very fine sandy loam that is light reddish brown, reddish brown, and brown.

The C horizon ranges from very fine sandy loam or silt loam to silty clay loam or clay loam. It is light reddish brown, reddish brown, reddish yellow, yellowish red, and red. Some profiles have a thin layer, which is darker than the surface layer, below a depth of 20 inches. A few profiles have a clay or silty clay layer more than 6 inches thick at a depth of 40 to 72 inches.

Clairemont silt loam (Ca).—This nearly level soil is on bottom lands along rivers and creeks throughout the county. It has the profile described as representative of the series. The largest acreage is on the flood plains of the Wichita River. Most areas are long, narrow strips that are parallel to stream channels. Areas range from 10 to several hundred acres in size. Slopes are dominantly about 0.5 percent.

Included with this soil in mapping are areas of soils that have a surface layer of silty clay loam. These soils occur on the slightly lower parts of flood plains. Narrow benches separating different levels of the flood plains that have slopes of more than 1 percent are included. Also included are spots of Yomont and Mangum soils.

The hazards of soil blowing and water erosion are slight on this Clairemont soil.

About 80 percent of the acreage is cultivated. Much of the acreage along the Wichita River is irrigated. Wheat is the major dryland crop. Alfalfa, small grain, and bermudagrass are the major irrigated crops. Some areas of this soil are occasionally flooded, but the water remains for only a few hours. Areas on higher benches are seldom flooded. This soil is well suited to most dryland and irrigated crops grown in the area. Irrigated areas of this soil have a moderate hazard of salinity, and crops that have a medium or high salt tolerance are better suited than other crops. Because of the low quality of irrigation water available, this soil requires leaching to keep salt accumulations at a safe level.

If this soil is cultivated, conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. Capability unit IIw-1, dryland; IIs-1; irrigated; Loamy Bottomland range site.

Clairemont-Urban land complex (Cb).—This mapping unit is on bottom lands along the Wichita River, mainly north of the central business district. Areas are irregular in shape and range from 5 to 130 acres in size. Slopes range from 0.4 to 1 percent.

About 30 percent of this mapping unit is Clairemont soils, 60 percent is Urban land, and 10 percent is other soils. The areas of the complex are too small and too intermingled to be separated at the scale mapped.

The Clairemont soils have a surface layer of reddish-brown silt loam about 9 inches thick. The underlying material, to a depth of 90 inches, is yellowish-red silty clay loam in the upper 35 inches and reddish-yellow very fine sandy loam below.

Urban land consists of works and structures, mostly houses, driveways, streets, and sidewalks. Commercial buildings and parking lots make up a small part of Urban land. The terrain is flat, and many of the areas have not been altered greatly by construction.

Included with this complex in mapping are areas of Yomont and Mangum soils.

Among the limitations to use of this complex for urban development are flooding from runoff and permeability, which causes seepage from sewage lagoons. Not assigned to a capability unit or to a range site.

Clairemont soils, wet (Cc).—These soils are on bottom lands along the Wichita River and its larger tributaries. Areas range from about 8 to 65 acres in size. Slopes are dominantly less than 1 percent.

The surface layer is reddish-brown silt loam about 7 inches thick. The underlying material, to a depth of 60 inches, is reddish brown. The upper part is clay loam, and the lower part is silt loam.

Included with these soils in mapping and making up 20 percent of the unit are areas of soils that have a darker surface layer than these Clairemont soils. Also included are areas of Yomont and Mangum soils, which make up about 10 percent of the unit. A few areas that have slopes of as much as 1.5 percent are also included.

The hazards of soil blowing and water erosion are slight on these soils.

Most of the acreage of these Clairemont soils is not cultivated. These soils either have a water table at a depth of about 2.5 to 6 feet or have restricted surface drainage that keeps them wet for long periods. Most areas can be drained by installing surface drains to remove surface water and to lower the water table.

These soils have a moderate to high hazard of salinity because of restricted drainage and leaching. The main concerns of management are maintaining or improving tilth, adapting suitable cropping systems, and managing water. Leaving crop residue on or near the surface helps to control evaporation, which brings harmful salts toward the surface. Mulches, such as cotton burs, also help to control evaporation. Capability unit VIw-1, dryland; IIw-1, irrigated, after drainage; Loamy Bottomland range site.

Cobb Series

The Cobb series consists of moderately deep, gently sloping, loamy soils on uplands. The soils formed in material weathered from medium-grained sandstone.

In a representative profile the surface layer is brown fine sandy loam about 6 inches thick. The next layer is 26 inches of reddish-brown and reddish-yellow, friable sandy clay loam. The underlying material is 8 inches or more of strong-brown, weakly cemented sandstone.

These soils are well drained and moderately permeable. Runoff is medium, and available water capacity is medium.

Representative profile of Cobb fine sandy loam, 1 to 3 percent slopes, 1.7 miles

south of Electra via Texas Highway 25, then 0.3 mile west on oilfield road, then 200 feet south, in an area of range:

A1—0 to 6 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; slightly hard, very friable; many roots; slightly acid, clear, smooth boundary.
B21t—6 to 20 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak, fine and medium, subangular blocky structure; hard, friable; many roots; thin, patchy clay films on surface of peds; neutral; clear, smooth boundary.
B22t—20 to 32 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, fine and medium, subangular blocky structure; hard, friable; common roots; thin, patchy clay films on surfaces of peds; few weakly cemented sandstone fragments; neutral; abrupt, irregular boundary.
C—32 to 40 inches, strong-brown (7.5YR 5/6) weakly cemented sandstone, interbedded with thin layers of red or gray, clayey shale; neutral.

The solum ranges from 20 to 40 inches in thickness.

The A horizon is brown, light brown, or reddish brown and is 6 to 9 inches thick. It is slightly acid or neutral.

The B21t horizon is sandy clay loam or clay loam that is reddish brown or light reddish brown. It ranges from 8 to 18 inches in thickness.

The B22t horizon is red, light red or reddish yellow and is 8 to 18 inches thick. It is slightly acid to mildly alkaline.

The C horizon is weakly to strongly cemented sandstone.

Cobb fine sandy loam, 1 to 3 percent slopes (CoB).—This gently sloping soil is on broad, low ridges or side slopes of ridges. The areas have a convex surface and range from 10 to 200 acres in size.

Included with this soil in mapping are areas of Oben and Bluegrove soils. Small areas of sandstone outcrop are also included.

The hazards of soil blowing and water erosion are moderate on this soil.

Most of the acreage of this Cobb soil is used as range. If this soil is cultivated, leaving crop residue on or near the surface helps to control erosion. Timely but limited tillage and contour cultivation, used along with terraces, are good management practices. Capability unit IIIe-4, dryland; Sandy Loam range site.

Deandale Series

The Deandale series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in red-bed clay and shale or in old alluvium derived from red-bed clay and shale.

In a representative profile the surface layer is dark grayish-brown silt loam about 12 inches thick. Below is 10 inches of dark-brown, very firm clay over 33 inches of reddish-brown, very firm clay; next is 20 inches of yellowish-red, firm clay over 15 inches of red, firm clay.

These soils are moderately well drained and very slowly permeable. Runoff is slow to medium, and available water capacity is high. The wet and saline phases are somewhat poorly drained and have medium available water capacity.

Representative profile of Deandale silt loam, 0 to 1 percent slopes, 8 miles north of Iowa Park, Texas, via Farm Road 368, then 0.5 mile east on Farm Road 2345, then 150 feet north, in an area of range:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard,

friable; slightly acid; abrupt, smooth boundary.

B21t—12 to 22 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium and fine, subangular blocky and blocky structure; very hard, very firm; few silt coatings between peds in upper part; thin continuous clay films on surfaces of peds; mildly alkaline; gradual, smooth boundary.

B22t—22 to 40 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky surface; very hard; very firm; thin, nearly continuous clay films on surfaces of peds; few, fine, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B23t—40 to 55 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate, medium blocky structure; very hard, very firm; thin, patchy clay films; few iron and manganese concretions; few salt crystals; common fine to medium calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B24t—55 to 75 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate, medium, blocky structure; very hard, firm; thin, patchy clay films; few iron and manganese concretions; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—75 to 90 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium, blocky structure; very hard, firm; thin patchy clay films; few fine iron and manganese concretions; common fine masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 inches to more than 80 inches in thickness. Depth to secondary carbonates is 6 to 28 inches.

The A1 horizon is brown, grayish brown, dark grayish brown, or dark brown and is 6 to 18 inches thick. It is slightly acid to mildly alkaline.

The upper part of the B2t horizon is clay that is brown, grayish brown, dark brown, dark grayish brown, or very dark grayish brown. The lower part is clay, clay loam, or sandy clay loam that is brown, dark brown, dark grayish brown, reddish brown, dark reddish brown, yellowish red, reddish yellow, or red; mottles of these colors are in some profiles. The B2t horizon is neutral to moderately alkaline.

Deandale silt loam, 0 to 1 percent slopes (DaA).—This nearly level soil is on upland flats. It has the profile described as representative of the series. Areas range from 10 to several hundred acres in size. Slopes are dominantly about 0.8 percent.

Included with this soil in mapping and making up 15 percent of the unit are Kamay and Tillman soils, which occupy areas that are more convex than those of this soil. Also included are areas of Hollister clay loam, which make up 5 percent of the unit.

The hazards of soil blowing and water erosion are slight on this soil.

About 50 percent of the acreage of this Deandale soil is cultivated. Wheat is the major crop. This soil is not suitable for irrigation with the quality of irrigation water available. It is droughty and is better suited to such cool-season crops as small grain than to other crops. Leaving crop residue on or near the surface helps to control evaporation of moisture, to increase moisture penetration, and to maintain soil tilth. Capability unit IIs-1, dryland; Claypan Prairie range site.

Deandale silt loam, 1 to 3 percent slopes (DaB).—This gently sloping soil is in areas that have a plane to weakly convex surface. Areas range from about 10 to 200 acres in size. Slopes are dominantly about 2 percent.

The surface layer is dark grayish-brown silt loam about 9 inches thick. Below is

about 23 inches of brown, very firm clay over about 34 inches of yellowish-red, very firm clay. Next, to a depth of 80 inches, is red clay.

Included with this soil in mapping are areas of Hollister, Frankirk, and Kamay soils.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About 50 percent of the acreage of this Deandale soil is cultivated. Wheat is the major crop. This soil is too droughty for summer tillage and is better suited to such cool-season crops as small grain than to other crops. Leaving crop residue on or near the surface helps to control water erosion and evaporation of moisture. Contour cultivation, used along with terraces, helps to conserve moisture and to control erosion. Capability unit IIIe-2, dryland; Claypan Prairie range site.

Deandale silt loam, loamy substratum, 0 to 1 percent slopes (DbA).—This nearly level soil is on terraces along rivers and larger creeks. Areas are irregular in shape and range from 10 to several hundred acres in size. Slopes are dominantly about 0.5 percent.

The surface layer is dark grayish-brown silt loam about 8 inches thick. Below this layer is about 14 inches of very dark grayish-brown, very firm clay over about 4 inches of dark-brown, very firm clay. Next is about 28 inches of brown, very firm clay over about 12 inches of dark-brown, very firm clay. Below is 8 inches of red, very firm clay over about 12 inches of reddish-brown, firm clay loam. Below, to a depth of 100 inches, is red sandy clay loam.

Included with this soil in mapping are areas of Winters soils. About 10 percent of these soils are leached of carbonates to a depth greater than 28 inches. A few small areas that have slopes of more than 1 percent are also included.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Deandale soil is cultivated and about 75 percent is irrigated. Cotton, small grain, and bermudagrass are the major crops. This soil has a high hazard of salinity when irrigated because of the very slow permeability and low quality of irrigation water available. This soil crusts readily, and stands of crops are likely to be poor as a result of poor germination. Adapting cropping systems to the soil limitations, preserving tilth, and maintaining productivity are the main concerns of management. This soil requires leaching to keep salt accumulations at a safe level. Fertilizing according to soil tests is also needed. Capability unit IIs-1, dryland; IVs-1, irrigated; Claypan Prairie range site.

Deandale silt loam, wet (Dc).—This nearly level soil is on terraces and in upland areas above the flood plain of the Wichita River. Areas are irregular in shape and range from 10 to 50 acres in size. Slopes are dominantly about 0.4 percent but range to about 1 percent.

The surface laver is brown silt loam about 6 inches thick. Below this layer is about 16 inches of dark-brown, very firm clay over about 26 inches of brown, very firm clay. Next is about 10 inches of reddish-brown, very firm clay over yellowish-red, very firm clay. Below, to a depth of 96 inches is yellowish-red clay loam.

Included with this soil in mapping are areas of Winters soils. Also included are areas of Deandale soils that are not wet.

The soil is used mostly for pasture and as range. Bermudagrass is generally suitable for pasture. This soil either has a water table at a depth of 5 to 7 feet or restricted surface drainage, and it is wet for significant periods. The hazard of salinity is moderate to high because of restricted drainage and leaching. The main concerns of management are to maintain or improve tilth, to adapt cropping systems to the soil limitations, and to manage water. Leaving crop residue on or near the surface helps to control evaporation, which brings harmful salts toward the surface. Mulches, such as cotton burs, also help to control evaporation. Capability unit VIw-1, dryland; IVw-1,

irrigated, after drainage; Claypan Prairie range site.

Deandale-Urban land complex (Dd).—This mapping unit is in the south, north, central, and eastern parts of the Wichita Falls area. It is nearly level and is on terraces along the Wichita River and Holliday Creek. The areas are irregular in shape and range from 20 to 155 acres. Slopes are dominantly about 0.5 percent, but they range from 0.3 to 1.3 percent.

About 30 percent of this mapping unit is Deandale soils, 60 percent is Urban land, and 10 percent is other soils. The areas are too small and too intermingled to be separated at the scale mapped.

The Deandale soils have a surface layer of dark grayish-brown silt loam about 10 inches thick. Below this layer is about 12 inches of dark-brown, very firm clay. Next is brown, very firm clay, about 26 inches thick, over about 30 inches of mottled yellowish-red and brown, firm clay. Below is 22 inches of red clay loam.

Urban land consists of works and structures, mostly houses, driveways, streets, and sidewalks. Commercial buildings, parking lots, and railroads make up a small part of Urban land. The terrain is flat, and many of the areas have not been altered greatly by construction.

Included with this complex in mapping are areas of Winters and Frankirk soils.

Among the limitations to use of this complex for urban development are shrink-swell, which causes cracking and shifting of structures; permeability, which contributes to failure of septic tank filter fields; and corrosivity, which results in failure of steel pipelines. Not assigned to a capability unit or to a range site.

Devol Series

The Devol series consists of deep, nearly level to gently sloping, sandy soils on uplands. The soils formed in coarse-textured eolian material or in alluvium reworked by soil blowing.

In a representative profile the surface layer is loamy fine sand about 14 inches thick; it is light brown in the upper 7 inches and reddish brown below. Below this layer is 36 inches of reddish-brown and light reddish-brown, very friable fine sandy loam. The underlying material is 22 inches or more of reddish-yellow loamy fine sand.

These soils are well drained and moderately rapidly permeable. Runoff is very slow, and available water capacity is medium.

Representative profile of Devol loamy fine sand, 0 to 3 percent slopes, about 2.8 miles southeast of Burkburnett via Texas Highway 240, then 5 miles east on Farm Road 1177, then 0.15 mile north on county road and 250 feet east, in a cultivated field:

Ap—0 to 7 inches, light-brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; neutral; abrupt, smooth boundary.

A1—7 to 14 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; single grained; loose; neutral; gradual, smooth boundary.

B21t—14 to 32 inches, reddish-brown (5YR 5/3) fine sandy loam, reddish brown (5YR 4/3) moist; weak, coarse, prismatic structure; slightly hard, very friable; neutral; few fine pores; few worm casts; gradual, smooth boundary.

B22t—32 to 50 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, coarse, prismatic structure; soft, very friable; neutral; gradual, smooth boundary.

C—50 to 72 inches, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; single grained; loose; mildly alkaline.

The A horizon is light brown, brown, or reddish brown and is 12 to 18 inches thick. It is neutral or mildly alkaline.

The B21t horizon is reddish brown or light reddish brown and is 10 to 18 inches

thick. It is neutral or mildly alkaline.

The B22t horizon is reddish brown or light reddish brown and is 12 to 24 inches thick. It is neutral or mildly alkaline.

The C horizon is reddish yellow, yellowish red, or brown and is at a depth of 40 to 60 inches. It is mildly or moderately alkaline. In some profiles buried horizons of sandy clay loam that is red, light yellowish brown, or grayish brown are below the C horizon at a depth of 40 to 80 inches.

Devol loamy fine sand, 0 to 3 percent slopes (DvB).—This soil is on uplands. Areas are irregular in shape and range from about 100 to 600 acres in size.

Included with this soil in mapping are areas of Tivoli soils, less than 5 acres in size, on ridgetops or at elevations on the landscape that are slightly higher than those of Devol soils. Also included in low spots are small, oval-shaped areas of Hardeman soils.

The hazard of soil blowing is severe, and the hazard of water erosion is slight on this soil.

About 80 percent of the acreage of this Devol soil is cultivated. Wheat is the major crop. Some oats, barley, vetch, and winter peas are also grown. Soil accumulations, a few inches to several feet in height, are along fence rows or other obstructions in some cultivated fields. Good management practices include leaving crop residue on or near the surface to help control soil blowing. Suitable crops include drilled or close-spaced sorghum, small grain, and grasses. Tillage needs to be held to a minimum. Stubble mulching is a preferred type of tillage. Some fertilizer should be used. Capability unit IIIe–1 dryland; Sandy Loam range site (grouped in this range site because of insignificant amount in range).

Enterprise Series

The Enterprise series consists of deep, nearly level to moderately steep, loamy soils on uplands. The soils formed in loamy eolian material.

In a representative profile the surface layer is reddish-brown very fine sandy loam about 20 inches thick. Below this layer is 20 inches of reddish-brown, very friable very fine sandy loam. The underlying material is 44 inches or more of reddish-yellow very fine sandy loam.

These soils are well drained and moderately rapidly permeable. Runoff is slow to medium, and available water capacity is high.

Representative profile of Enterprise very fine sandy loam, 1 to 3 percent slopes, 0.2 mile northwest on truck route from its intersection with Texas Highway 240 at the east edge of Burkburnett, then 0.4 mile north along fence line, then 90 feet east, in a cultivated field:

Ap—0 to 60 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 20 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak, medium subangular blocky and granular structure; soft, very friable; common very fine and few fine pores; calcareous; moderately alkaline; few worm casts; gradual, smooth boundary.

B2—20 to 40 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, very friable; common very fine and few fine pores; few worm casts; few to common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C—40 to 84 inches, reddish-yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

Depth to calcareous material is 0 to 24 inches.

The A horizon is light brown, brown, light reddish brown, or reddish brown and is 10 to 30 inches thick.

The B2 horizon is light reddish brown, reddish brown, reddish yellow, and yellowish red and is 12 to 32 inches thick.

The C horizon is reddish brown, light reddish brown, reddish yellow, or yellowish red and is at a depth of 22 to 60 inches. It is dominantly very fine sandy loam, but in a few profiles it ranges to loam below a depth of 40 inches. In some profiles buried horizons of calcareous sandy clay loam to clay loam that is grayish brown to red are at a depth of 40 to 80 inches.

Enterprise very fine sandy loam, 0 to 1 percent slopes (EnA).—This nearly level soil is on uplands, mostly above the flood plains of the Red River. Areas have a plane to weakly convex surface, are irregular to elongated in shape, and range from about 10 to several hundred acres in size. Most areas are more that 40 acres in size. Slopes are dominantly less than 0.5 percent.

The surface layer is very fine sandy loam about 22 inches thick. It is brown in the upper 8 inches and reddish brown below. Below this layer is about 20 inches of reddish-brown, very friable very fine sandy loam. The underlying material is yellowish-red very fine sandy loam.

Included with this soil in mapping are small areas, mainly less than 5 acres in size, of Tipton soils, which occupy slightly lower positions on the landscape than this Enterprise soil. Narrow bands of Hardeman soils, which occupy slightly higher positions on the landscape than this soil, are included. Also included, and making up about 25 percent of the unit, are soils that are leached of carbonates to a depth below 24 inches.

The hazard of soil blowing and water erosion are slight.

Almost all of the acreage of this Enterprise soil is cultivated. Wheat is the major crop. Some alfalfa, winterpeas, cotton, and bermudagrass are also grown. The soil is suited to nearly all crops grown in the area. Conserving moisture, maintaining soil tilth, and maintaining productivity are the main concerns of management. The cropping system should include sorghum, small grain, and other crops that leave a large amount of residue on or near the surface. Terraces help in conserving water. Capability unit IIc-2, dryland; Mixedland range site.

Enterprise very fine sandy loam, 1 to 3 percent slopes (EnB).—This gently sloping soil is on uplands, mostly above the flood plains of the Red River. It has the profile described as representative of the series. Areas have a plane to convex surface and range from about 10 to several hundred acres in size. Most areas are more than 40 acres in size. Slopes are dominantly about 2 percent.

Included with this soil in mapping are small areas, mainly less than 5 acres in size, of Hardeman soils, which occupy slightly higher positions on the landscape than this Enterprise soil. Also included are a few narrow areas of Motley soils, which are on the outer edges of some areas, mainly on the south side farther from the Red River. All of these inclusions make up less than 10 percent of the unit.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About 85 percent of the acreage of this Enterprise soil is cultivated. Wheat is the major crop. Some alfalfa, winterpeas, cotton, and bermudagrass are grown. The soil is suited to nearly all crops grown in the area. Gullies form easily if runoff concentrates on unprotected areas.

Good management practices include crop rotation, leaving crop residue on or near the surface to help control erosion and to improve tilth, and limited but timely tillage. Contour cultivation, along with the use of terraces, is needed to help control water erosion. In places diversion terraces and grassed waterways are needed for

safe disposal of runoff water. Capability unit IIe-1, dryland; Mixedland range site.

Enterprise very fine sandy loam, 3 to 5 percent slopes (EnC).—This gently sloping soil is on uplands, mostly above the flood plains of the Red River. Areas are almost parallel to the flood plain. Some areas follow the slope contours above the drainage patterns. Most areas range from 10 to 80 acres in size.

The surface layer is reddish-brown very fine sandy loam about 10 inches thick. Below this layer is 28 inches of reddish-brown, very friable very fine sandy loam. The underlying material, to a depth of 72 inches or more, is light reddish-brown very fine sandy loam.

Included with this soil in mapping, near the flood plain of the Red River, are narrow bands, mainly less than 5 acres in size, of Hardeman soils. Also included are small areas that have slopes of 1 to 3 percent and 5 to 8 percent.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About 70 percent of the acreage of this Enterprise soil is cultivated. Wheat is the major crop. Some winter-peas, oats, barley, and bermudagrass are also grown. The soil gullies easily if runoff water concentrates on unprotected areas (fig. 6). There are shallow gullies and rills, more than 100 feet apart, which are crossable with tillage implements. A few U-shaped gullies, 2 to 6 feet deep, are in some unprotected areas where runoff water concentrates.

Figure 6.—Roadbank erosion on an area of Enterprise very fine sandy loam, 3 to 5 percent slopes.

Leaving crop residue on or near the surface helps to control erosion. Timely but limited tillage and contour cultivation, along with the use of terraces, are good management practices. Capability unit IIIe-5, dryland; Mixedland range site.

Enterprise very fine sandy loam, 5 to 8 percent slopes (EnD).—This sloping soil is on uplands, mostly above the flood plain of the Red River. Areas are long and narrow and range from about 10 to 100 acres in size. Many areas are almost parallel to the river flood plain; some are along creeks draining to the river.

The surface layer is reddish-brown very fine sandy loam about 12 inches thick. Below this layer is about 18 inches of light reddish-brown, very friable very fine sandy

loam. The underlying material is reddish-yellow very fine sandy loam.

Included with this soil in mapping near the flood plain of the Red River are narrow bands, mainly less than 5 acres in size, of Hardeman soils. Also included are narrow areas that have slopes of 3 to 5 percent.

The hazard of soil blowing is slight, and the hazard of water erosion is severe on this soil.

About 30 percent of the acreage of this Enterprise soil is cultivated. The soil is better suited to range than to other purposes (fig. 7). Wheat is the major crop. Other small grain and winterpeas are also grown. Under careful management that includes practices to help control erosion, this soil can be used for crops. The soil gullies easily if runoff water concentrates on unprotected areas. There are a few shallow gullies and rills, more than 100 feet apart, which are crossable with tillage implements. A few U-shaped gullies, 2 to 10 feet deep, are in some areas where runoff water concentrates.

Figure 7.—An area of Enterprise very fine sandy loam, 5 to 8 percent slopes, that has been seeded to little bluestem.

Good management practices include leaving crop residue on or near the surface to help control water erosion. The cropping system should include drilled or close-spaced sorghum, small grain, and grasses. Tillage needs to be held to a minimum.

Some fertilizer should be used. Capability unit IVe-1, dryland; Mixedland range site.

Enterprise very fine sandy loam, 8 to 20 percent slopes (EnE).—This strongly sloping to moderately steep soil is on uplands. The areas are long and narrow and range from about 10 to several hundred acres in size. The largest areas are on a steep scarp adjacent to the flood plain of the Red River (fig. 8). Other areas are on slope faces flanking creeks and intermittent streams draining to the river. Slopes dominantly range from 10 to 12 percent.

Figure 8.—Typical topography of Enterprise very fine sandy loam, 8 to 20 percent slopes. This soil is on breaks from uplands to bottom lands.

The surface layer is reddish-brown very fine sandy loam about 11 inches thick. Below this layer is about 23 inches of light reddish-brown, very friable very fine sandy loam. The underlying material, to a depth of 84 inches or more, is reddish-yellow very fine sandy loam.

Included with this soil in mapping are narrow bands of Tivoli soils on steep scarp faces adjacent to the river flood plain. Also included are a few small areas of Hardeman soils on ridgetops close to the river. Another inclusion, making up about 10 percent of the total acreage of this Enterprise soil, is eroded areas on some of the steeper scarp faces and along overfall gullies where runoff water concentrates.

Nearly all of this soil is used as range. It is unsuited to cultivation because of the steep slopes and a severe hazard of water erosion. The soil gullies easily if runoff water concentrates on unprotected areas. Good management consists of proper grazing practices, including rest periods from grazing during the growing season, and control of brush. Capability unit VIe-2, dryland; Mixedland range site.

Fluvents

Fluvents consist of gently sloping to steep clayey material that has been exposed as a result of gully erosion. Areas of Fluvents are on bottom lands.

The soil material is reddish-brown clay that has a stratum of dark material to a depth of 60 inches.

These soils are excessively drained and very slowly permeable. Runoff is very rapid, and available water capacity is high.

Fluvents are mapped only in a complex with Mangum soils.

Frankirk Series

The Frankirk series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in loamy old alluvial sediment.

In a representative profile the surface layer is brown loam about 7 inches thick. Below this layer is about 6 inches of reddish-brown clay loam over 17 inches of reddish-brown firm clay. Next is red, firm or friable clay 25 inches thick over 15 inches of red, friable clay loam.

These soils are well drained and moderately slowly permeable. Runoff is slow to medium, and available water capacity is high.

Representative profile of Frankirk loam, 1 to 3 percent slopes, 2.8 miles northeast via Farm Road 171 from its intersection with Texas Highway 240 in Wichita Falls, then 150 feet north, in a cultivated field:

Ap—0 to 7 inches, brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, granular and blocky structure; slightly hard, very friable; slightly acid; abrupt, smooth boundary.

B1—7 to 13 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate, medium, blocky structure; hard, firm; few thin clay films; neutral; clear, smooth boundary.

B21t—13 to 30 inches, reddish-brown (5YR 4/4) clay, reddish brown (5YR 4/4) moist; moderate, medium, blocky structure; very hard, firm; common distinct clay films; neutral; gradual, smooth boundary.

B22t—30 to 40 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium, blocky structure; very hard, firm; distinct clay films; neutral; gradual, wavy boundary.

B23tca—40 to 55 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; few thin clay films; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B3—55 to 70 inches, red (2.5YR 5/6) clay loam; red (2.5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; few thin clay films; few calcium carbonate films; calcareous; moderately alkaline.

The solum ranges from 60 to 90 inches in thickness. Secondary lime is at a depth of 29 to 48 inches.

The A horizon is reddish brown, brown, or dark brown and is 5 to 9 inches thick. It is slightly acid to neutral.

The B1 horizon is clay loam to clay that is reddish brown, brown, or dark brown. It ranges from 5 to 9 inches in thickness and is neutral or mildly alkaline.

The B2t horizon is clay loam to clay and is neutral to moderately alkaline.

The B2t and B3 horizons are light reddish brown, reddish brown, reddish yellow, yellowish red, and red.

The content of calcium carbonate in the lower part of the Bt horizon ranges from a few concretions to about 15 percent of the horizon, by volume.

Frankirk loam, 0 to 1 percent slopes (FrA).—This nearly level soil is in areas that have a smooth to weak, convex surface. Areas are irregular in shape and range from 10 to several hundred acres in size.

The surface layer is brown loam about 8 inches thick. Below the layer is about 8 inches of dark-brown, friable clay loam over about 14 inches of reddish-brown, firm clay. Next is about 10 inches of red, firm clay over about 20 inches of yellowish-red, firm clay. Below, to a depth of about 95 inches, is reddish-yellow and yellowish-red, friable clay loam.

Included with this soil in mapping are areas of Rotan soils in lower, slightly concave areas. Also included are areas of Motley, Kamay, and Bluegrove soils and areas of Winters soils, which make up about 10 percent of the acreage. Soils that are similar to Frankirk soils but have carbonates leached to a depth below 48 inches are included. Soils that are similar to Frankirk soils but have carbonates at a depth of less than 29 inches are also included.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Frankirk soil is cultivated. Wheat is the major dryland crop. Wheat, alfalfa, and bermudagrass are the major irrigated crops. This soil has a medium to high hazard of salinity when irrigated, because of the quality of irrigation water available. Good management practices include crop rotation, leaving crop residue on or near the surface, and timely but limited tillage. If this soil is irrigated, crops of medium to high salt tolerance should be used. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that permit effective leaching and efficient use of rainfall are needed. Capability unit IIc-1, dryland; IIIs-1, irrigated; Clay Loam range site.

Frankirk loam, 1 to 3 percent slopes (FrB).—This gently sloping soil is in upland areas that have a convex surface. It has the profile described as representative of the series. Areas are irregular in shape and range from about 10 to 300 acres in size. Most areas are less than 100 acres in size. Slopes are dominantly about 2 percent.

Included with this soil in mapping are areas of Motley, Kamay, and Bluegrove soils. Also included are areas of Winters soils, which make up about 15 percent of the unit.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

Most of the acreage of this Frankirk soil is used for dryland crops. Wheat is the major crop. This soil has a medium to high hazard of salinity when irrigated because of the quality of irrigation water available. Good management practices include crop rotation, leaving crop residue on or near the surface, and limited but timely tillage. Contour cultivation, along with the use of terraces, is needed to help control water erosion. If this soil is irrigated, crops of medium to high salt tolerance should be used. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that will permit effective leaching and efficient use of rainfall are needed. Capability unit IIe-2, dryland; IIIs-2, irrigated; Clay Loam range site.

Grandfield Series

The Grandfield series consists of deep, gently sloping, loamy soils on uplands. The soils formed in old alluvial sediment.

In a representative profile the surface layer is reddish-brown fine sandy loam about 6 inches thick. Below this layer is 8 inches of reddish-brown, friable sandy clay loam; next is red, friable sandy clay loam about 42 inches thick. The underlying material is 24 inches of red fine sandy loam that contains strata of coarse sand and gravel.

These soils are well drained and moderately permeable. Runoff is medium, and available water capacity is high.

Representative profile of Grandfield fine sandy loam, 1 to 3 percent slopes, 0.9 mile west via Texas Highway 258 from its intersection with Farm Road 1206 in Kamay, Texas, then 0.2 mile south, in an area of range:

A1—0 to 6 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; slightly hard, very friable; slightly acid; clear, smooth boundary.

B21t—6 to 14 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak, coarse, prismatic structure, parting to weak to moderate, fine, subangular blocky; hard, friable; few fine pores; few, thin, patchy clay films on surfaces of peds; neutral; gradual, smooth boundary.

B22t—14 to 30 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak, coarse, prismatic structure, parting to weak, medium, subangular blocky; hard, friable; common fine pores; few, thin, patchy clay films on surfaces of peds; neutral; gradual, smooth boundary.

B23t—30 to 56 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; less clayey than horizons above; weak, medium, subangular blocky structure; hard, friable; few thin, patchy clay films on surfaces of peds; mildly alkaline; gradual, smooth boundary.

C—56 to 80 inches, red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; strata of coarse sand and gravel; massive; slightly hard, very friable; noncalcareous; moderately alkaline.

The solum ranges from 49 to more than 72 inches in thickness.

The A horizon is reddish brown, brown, or dark brown and is 6 to 10 inches thick. It is slightly acid or neutral.

The Bt horizon is fine sandy loam to sandy clay loam that is reddish brown, yellowish red, reddish yellow, or red. It ranges from 40 to more than 60 inches in thickness and is slightly acid to moderately alkaline.

The B3 horizon, where it occurs, is fine sandy loam to sandy clay loam that is yellowish red or red.

The C horizon is fine sandy loam, loam, or loamy fine sand that is red, light red, or reddish yellow and contains strata of coarser textured material.

Grandfield fine sandy loam, 1 to 3 percent slopes (GfB). —This gently sloping soil is in areas that have a convex surface. Areas range from 50 to 150 acres in size. They are on river terraces and are oval in shape. Slopes are dominantly about 1.5 percent.

Included with this soil in mapping and making up about 10 percent of the unit are areas of Winters soils. Also included and making up about 10 percent of the unit are soils in which the lower layer of sandy clay loam extends to a depth of more than 60 inches.

The hazards of soil blowing and water erosion are moderate on this soil.

Most of the acreage of this Grandfield soil is cultivated and about 50 percent is irrigated. Small grain and bermudagrass are the major crops. This soil has a medium hazard of salinity when irrigated, because of the quality of irrigation water available. If the soil is cultivated, leaving crop residue on or near the surface helps to control erosion. Timely but limited tillage and use of contour cultivation, along with the use of terraces, is needed. If this soil is irrigated, crops of medium salt tolerance should be used. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that permit effective leaching and efficient use of rainfall are needed. Capability unit IIe-3, dryland; IIs-1, irrigated; Sandy Loam range site.

Hardeman Series

The Hardeman series consists of deep, gently sloping, loamy soils on uplands. The soils formed in loamy eolian material.

In a representative profile the surface layer is fine sandy loam about 16 inches thick. It is brown in the upper 8 inches and reddish brown below. Below this layer is 20 inches of reddish-brown, very friable fine sandy loam. The underlying material, to a depth of 96 inches, is yellowish-red fine sandy loam.

These soils are well drained and moderately rapidly permeable. Runoff is slow to medium, and available water capacity is medium.

Representative profile of Hardeman fine sandy loam, 1 to 3 percent slopes, 0.8 mile southeast via Texas Highway 240 from its intersection with U.S. Highway 277 in the southeast part of Burkburnett, Texas, then 1,160 feet north on private road, and 200 feet east, in a cultivated field:

Ap—0 to 8 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

A1—8 to 16 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, subangular blocky and granular structure; slightly hard, very friable; few fine pores and many very fine pores; few worm casts; neutral; gradual, smooth boundary.

B2—16 to 36 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, coarse, prismatic structure parting to medium subangular blocky; slightly hard, very friable; few fine pores and many very fine pores; few worm casts; mildly alkaline; gradual, smooth boundary.

C1—36 to 58 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; mildly alkaline; gradual, smooth boundary.

C2—58 to 96 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few threads and films and small, soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon is light brown, brown, light reddish brown, or reddish brown and is 10 to 18 inches thick. It is neutral or mildly alkaline.

The B2 horizon is reddish brown, reddish yellow, or yellowish red and is 10 to 24 inches thick. It is mildly alkaline or moderately alkaline.

The C horizon is light reddish brown, reddish brown, reddish yellow, yellowish red, brown, or light brown and is at a depth of 30 to 50 inches. It is mildly to moderately alkaline. Few to common threads and films and a few soft masses of calcium carbonate are in this horizon in some profiles. Buried horizons of sandy clay loam to clay loam that is brown, pale brown, or reddish brown are at a depth of 46 to 60 inches in some profiles.

Hardeman fine sandy loam, 1 to 3 percent slopes (HaB). —This gently sloping soil is in upland areas that have a plane to convex surface. It has the profile described as representative of the series. Areas are irregular in shape and range from about 20 to several hundred acres in size. Most areas are at slightly higher elevations on the landscape than the associated Enterprise soils. Slopes are dominantly about 1.5 percent.

Included with this soil in mapping are small areas, less than 5 acres, of Enterprise soils. The areas are somewhat oval and are slightly lower on the landscape than those of this Hardeman soil. Also included are small areas of Devol soils on ridgetops. A few areas that have slopes of slightly less than 1 percent are included.

The hazard of soil blowing is moderate, and the hazard of water erosion is slight on this soil.

About 85 percent of the acreage of this soil is used for crops. Wheat is the main crop, but some alfalfa, winterpeas, vetch, oats, and cotton are grown. A few shallow gullies and rills are in some unprotected cultivated areas. The hazard of soil blowing is evident by low accumulations of soil along fence rows or other obstructions. Leaving crop residue on or near the surface and timely but limited tillage help to control erosion. In places emergency tillage is necessary to roughen the surface of the soil when residue is inadequate to provide a protective cover. This soil responds to applications of fertilizer. Capability unit IIIe-6, dryland; Sandy Loam range site.

Hardeman fine sandy loam, 3 to 5 percent slopes (HaC). —This gently sloping soil is on ridgetops or side slopes flanking drainageways. The areas have a plane to convex surface, are mostly irregular in shape, and range from 10 to 70 acres in size. Slopes are dominantly about 4 percent.

The surface layer is fine sandy loam about 15 inches thick, brown in the upper part and reddish brown in the lower part. Below this layer is 18 inches of reddish-brown, very friable fine sandy loam. The underlying material is light-brown fine sandy loam.

Included with this soil in mapping are areas, less than 5 acres, of Enterprise soils along natural drainageways and at slightly lower elevations on the landscape than these Hardeman soils. Also included are areas of Devol soils on narrow ridgetops.

The hazards of soil blowing and water erosion are moderate on this soil.

About 80 percent of the acreage of this Hardeman soil is cultivated. Wheat is the major crop. Some winterpeas, vetch, oats, and barley are also grown. A few shallow gullies about 100 feet apart are in some unprotected cultivated fields. Leaving crop residue on or near the surface and timely but limited tillage help to control soil blowing. In places emergency tillage is needed to roughen the surface of the soil if residue is inadequate to provide a protective cover. This soil responds to applications of fertilizer. Capability unit IIIe-8, dryland; Sandy Loam range site.

Hollister Series

The Hollister series consists of deep, nearly level, loamy soils on uplands. The soils formed in ancient alluvium derived from red-bed clay and shale.

In a representative profile the surface layer is dark grayish-brown clay loam about 9 inches thick. Below this layer is 34 inches of dark-brown clay. Next is clay, about 37 inches thick, that is reddish brown in the upper part, yellowish red in the middle part, and red in the lower part. The underlying material is 10 inches of dark-red clay.

These soils are well drained and slowly permeable. Runoff is slow, and available water capacity is high.

Representative profile of Hollister clay loam, 0 to 1 percent slopes, 1.8 miles west via Farm Road 1739 from its intersection with Farm Road 2384, then 0.5 mile north on private road, and 50 feet west, in an area of range:

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular and subangular blocky structure; hard, friable; neutral; clear, smooth boundary.

B21t—9 to 24 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium and coarse, blocky structure; very hard, firm; few thin films on surfaces of peds; mildly alkaline; gradual, smooth boundary.

B22t—24 to 43 inches, dark-brown (7.5YR 4/4) clay, dark brown (7.5YR 4/4) moist; moderate, medium and coarse, blocky structure; very hard, very firm; common distinct clay films on peds; few calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B23t—43 to 55 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, very firm; few thin clay films on peds; few calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—55 to 67 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate, medium, blocky structure; hard, firm; few clay films; 5 percent, by volume, calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

B25t—67 to 80 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate, medium, blocky and subangular blocky structure; hard, firm; few thin clay films; few calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

C—80 to 90 inches, dark-red (2.5YR 3/6) clay; massive; very hard, very firm; clayey red beds; calcareous; moderately alkaline.

The solum ranges from 60 to more than 90 inches in thickness. Depth to calcareous material is 8 to 28 inches.

The A horizon is dark brown, brown, dark grayish brown, or grayish brown and is 4 to 10 inches thick.

The B2t horizon is dark brown, brown, dark grayish brown, or grayish brown in the upper part and reddish brown, yellowish red, and red in the lower part. It ranges from 65 to more than 80 inches in thickness.

Hollister clay loam, 0 to 1 percent slopes (HoA).—This nearly level soil is on uplands. The areas have a plane surface and range from about 10 to 300 acres in size. Most areas are less than 75 acres in size.

Included with this soil in mapping are areas of Deandale soils and Tillman soils. Tillman soils are in areas that are slightly higher and more convex than those of this Hollister soil.

The hazards of soil blowing and water erosion are slight.

About 50 percent of the acreage of this Hollister soil is cultivated. Wheat is the major crop. This soil is too droughty for summer tillage. It is not suitable for irrigation with the quality of irrigation water available. Good management practices include crop rotation, leaving crop residue on or near the surface, and timely but limited tillage. Capability unit IIc-1, dryland; Clay Loam range site.

Kamay Series

The Kamay series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in ancient alluvium derived from red-bed clay and shale.

In a representative profile the surface layer is dark grayish-brown silt loam about 10 inches thick. Below this layer is 26 inches of reddish-brown clay that is very firm in the upper 7 inches and firm below. Next is yellowish-red and red, firm clay 54 inches thick. The underlying material is 10 inches of red clayey shale (fig. 9).

These soils are well drained and very slowly permeable. Runoff is slow to medium, and available water capacity is high.

Representative profile of Kamay silt loam, 1 to 3 percent slopes, 8 miles north of Iowa Park, Texas, via Farm Road 368, then 3 miles east on Farm Road 2345, then 0.7 mile north on county road and 400 feet east, in an area of range:

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; massive; very hard when dry, friable; common fine roots; neutral; abrupt, smooth boundary.

B21t—10 to 17 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium and fine, subangular blocky and blocky structure; very hard, very firm; many clay films; neutral; clear, smooth boundary.

B22t—17 to 36 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, firm; many clay films; mildly alkaline to a depth of 24 inches, moderately alkaline below; calcareous; gradual, wavy boundary.

B23tca—36 to 58 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate, medium, blocky structure; very hard, firm; many clay films; about 5 percent, by volume, calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

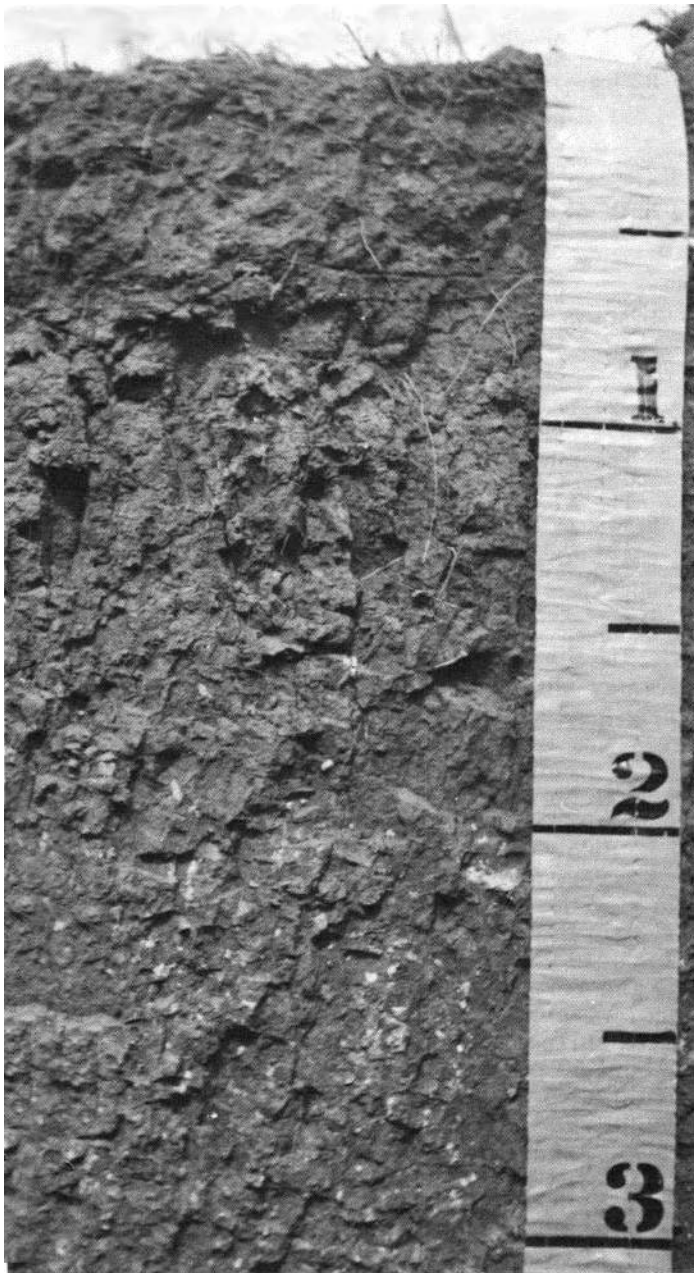


Figure 9.—Profile of a Kamay silt loam. The visible content of carbonates is at a depth of less than 2 feet.

B24t—58 to 75 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium, blocky structure; very hard, firm; many clay films; few calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—75 to 90 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, coarse, blocky structure; very hard, firm; few clay films; calcareous; moderately alkaline; gradual, wavy boundary.

C—90 to 100 inches, dark-red (10R 3/6) clayey shale; massive.

The solum ranges from 60 to more than 80 inches in thickness. Depth to secondary carbonates is 12 to 28 inches.

The A1 horizon is grayish brown, dark grayish brown, brown, or dark brown and is 5 to 12 inches thick.

The B2t horizon is clay loam or clay that is reddish brown, brown, dark brown, or dark grayish brown in the upper part and light reddish brown, reddish yellow, yellowish red, or red in the lower part. It is neutral to moderately alkaline.

The C horizon is clay to clayey shale.

Kamay silt loam, 0 to 1 percent slopes (KaA).—This nearly level soil is in areas that have a plane surface. Areas are irregular in shape and range from 5 to several hundred acres in size. Slopes are dominantly about 0.5 percent.

The surface layer is brown silt loam about 8 inches thick. Below this layer is about 16 inches of reddish-brown, very firm clay over about 30 inches of red, very firm clay. Next, to a depth of about 90 inches, is red, very firm clay.

Included with this soil in mapping are areas of Deandale and Vernon soils. The Deandale soils are in depressions. Vernon soils are in higher areas that have a convex surface.

About 50 percent of the acreage of this Kamay soil is cultivated. Wheat is the major crop. This soil is droughty and is better suited to such cool-season crops as small grain than to other crops. It is not suitable for irrigation with the quality of irrigation water available. Leaving crop residue on or near the surface helps to control evaporation of moisture and to maintain the supply of organic matter. Capability unit IIs-1, dry-land; Claypan Prairie range site.

Kamay silt loam, 1 to 3 percent slopes (KaB).—This gently sloping soil is on uplands. It has the profile described as representative of the series. Areas have a plane to convex surface, are irregular in shape, and range from 10 to several hundred acres in size. Slopes are dominantly about 2 percent.

Included with this soil in mapping are small areas, mainly less than 3 acres in size, of Vernon soils on low, rounded hilltops and on the side slopes flanking natural drainageways. Narrow areas of Bluegrove soils on hilltops are included. Also included are small areas of Tillman soils and concave areas of Deandale soils.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About half of the acreage of this Kamay soil is cultivated. A few areas are irrigated or were irrigated atone time. However, this soil is not suitable for irrigation with the low quality of irrigation water available. This soil is well suited to cool-season crops. Wheat is the major crop. Leaving crop residue on or near the surface helps to control water erosion and cuts down on evaporation of moisture. Contour cultivation, used along with terraces, helps to conserve moisture and control erosion. Capability unit IIIe-2, dryland; Claypan Prairie range site.

Kamay-Urban land complex, 0 to 3 percent slopes (KCB).—This mapping unit is in the north-central, central, and south-central parts of the Wichita Falls area. It is nearly level to gently sloping and is on uplands. Areas are irregular in shape and range from 8 to several hundred acres in size. Slopes are dominantly about 1.5 percent.

About 30 percent of this mapping unit is Kamay soils, 60 percent is Urban land, and 10 percent is other soils. Areas are too small and too intermingled to be separated at the scale mapped.

The Kamay soil has a surface layer of brown silt loam about 12 inches thick. Below this layer is about 29 inches of reddish-brown, very firm clay over about 30 inches of red, very firm clay. Next, to a depth of 76 inches, is red clayey shale.

Urban land consists of works and structures, such as houses, streets, driveways,

sidewalks, commercial buildings, parking lots, and schools. Other than preparing the sites for buildings and shallow cutting for streets and curb installation, the soil has not been altered greatly by construction.

Included with this complex in mapping are areas of Tillman, Bluegrove, Vernon, and Deandale soils.

Among the limitations to use of this complex for urban development are shrink-swell, which causes cracking and shifting of structures; permeability, which contributes to failure of septic tank filter fields; and corrosivity, which results in failure of steel pipelines. Water erosion is a concern on unprotected construction sites (fig. 10). Not assigned to a capability unit or to a range site.

Figure 10.—Construction site in housing development on an area of Kamay silt loam. Note that the unprotected areas are eroding.

Kirkland Series

The Kirkland series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in material weathered from clay or clayey shale.

In a representative profile the surface layer is dark-brown silt loam about 9 inches thick. Below this layer is 18 inches of dark-brown, very firm clay over brown, very firm clay about 51 inches thick. The underlying material is 22 inches or more of interbedded red and light olive-gray clayey shale.

These soils are well drained and very slowly permeable. Runoff is slow to medium, and available water capacity is high.

Representative profile of Kirkland silt loam, 0 to 1 percent slopes, 0.4 mile west on Rathgeber Road from its intersection with U.S. Highway 281, then 50 feet north, in an area of range:

A11—0 to 6 inches, dark-brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak, fine, granular structure, slightly hard, friable; many roots; few fine pores; neutral; clear, smooth boundary.

A12—6 to 9 inches, dark-brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; distinct gray coatings on surfaces of peds when dry; weak, fine, granular structure; slightly hard, friable; neutral; many roots; few fine pores; abrupt, wavy boundary.

B21t—9 to 17 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; strong, fine and medium, blocky structure; very hard, very firm; common roots, mainly between peds; distinct clay films on surfaces of peds; mildly alkaline; clear, smooth boundary.

B22t—17 to 27 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, coarse and medium, blocky structure; very hard, very firm; common roots, mainly between peds; few fine pores; distinct clay films on surfaces of peds; few calcium carbonate concretions; mildly alkaline; gradual, smooth boundary.

B23t—27 to 47 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, coarse and medium, blocky structure; very hard, very firm; few roots; few clay films on surfaces of peds; calcareous; moderately alkaline; gradual, smooth boundary.

B24t—47 to 78 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; about 15 percent of the soil mass is mottled with brown (7.5YR 5/3); moderate, medium, blocky structure; very hard, very firm; few roots; few clay films on surfaces of peds; few fine and medium calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

C—78 to 100 inches, interbedded dark-red (10R 3/6) and light olive-gray (5Y 6/2) clayey shale; weak, coarse, subangular blocky structure; calcareous; moderately alkaline.

The A1 horizon is brown, dark brown, dark grayish brown, or grayish brown and is 8 to 13 inches thick. It is slightly acid or neutral. Cracks from 1 centimeter to 3 centimeters wide extend from the surface to a depth of about 2 to 6 feet.

The B21t horizon is grayish brown, dark grayish brown, brown, or dark brown and is 6 to 15 inches thick. It is neutral or mildly alkaline.

The B22t and B23t horizons are dark brown, brown, or reddish brown and are 18 to 50 inches thick. They are neutral to moderately alkaline.

The B24t horizon is dark brown, brown, strong brown, reddish brown, yellowish red, or red and is 8 to 34 inches thick.

Depth to the C horizon ranges from 60 to more than 80 inches. The C horizon is red, olive gray, light olive gray, yellow, or brown.

Carbonates are at a depth of 16 to 38 inches. The soils that have carbonates at a depth of less than 28 inches are outside the range for the series. This difference does not affect the usefulness, management, or behavior of these soils.

Kirkland silt loam, 0 to 1 percent slopes (KrA).—This nearly level soil is in upland areas that have a plane to weakly concave surface. It has the profile described as representative of the series. Areas range from 50 to 200 acres in size. Slopes are dominantly 0.5 percent.

Included with this soil in mapping are areas of Renfrow and Kamay soils, each of which makes up 10 percent of the unit. Small areas of Waurika soils are also included.

The hazards of soil blowing and water erosion are slight on this soil.

About 75 percent of the acreage of this Kirkland soil is used as range. This soil is better suited to cool-season crops than to other crops. Wheat is the major crop. Leaving crop residue on or near the surface helps to control evaporation of moisture and to maintain the supply of organic matter. Capability unit IIs-1, dryland; Claypan Prairie range site.

Kirkland silt loam, 1 to 3 percent slopes (KrB).—This gently sloping soil is in upland areas that have a plane surface. Areas range from 20 to 100 acres in size and are irregular in shape. Slopes are dominantly 1.5 percent.

The surface layer is silt loam about 9 inches thick. It is dark grayish brown in the upper part and dark brown in the lower part. Below this layer is about 7 inches of dark grayish-brown, very firm clay over about 10 inches of dark-brown, very firm clay. Next is about 24 inches of brown, very firm clay. The underlying material is olive-gray clayey shale, to a depth of about 80 inches.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

Included with this soil in mapping are areas of Renfrow and Kamay soils, which make up about 10 percent and 12 percent of the unit, respectively. Small areas of Bluegrove soils on small ridges and knobs are also included.

Most of the acreage of this Kirkland soil is used as range. This soil is better suited to such cool-season crops as small grain than to other crops. Leaving crop residue on or near the surface helps to control water erosion and cuts down on evaporation of moisture. Contour cultivation using terraces helps to conserve moisture and control erosion. Capability unit IIIe-2, dry-land; Claypan Prairie range site.

Knoco Series

The Knoco series consists of very shallow, gently sloping to moderately steep and rolling clayey soils on uplands. The soils formed in red-bed clay and shale.

In a representative profile the surface layer is red clay about 5 inches thick. The underlying material is 15 inches or more of red clayey shale that has light-gray mottles.

These soils are somewhat excessively drained and very slowly permeable. Runoff is rapid, and available water capacity is low.

Knoco soils are mapped only in a complex with Owens soils.

Representative profile of Knoco clay in an area of Owens-Knoco complex, 3 to 15 percent slopes, 0.3 mile north via Farm Road 369 from its intersection with U.S. Highway 277 and 82, then 0.5 mile west, in an area of range:

A1—0 to 5 inches, red (2.5YR 5/6) clay, dark red (2.5YR 3/6) moist; light-gray spots in places; weak, medium, blocky structure; very hard, very firm; very sticky, very plastic; few roots; calcareous; moderately alkaline; clear, smooth boundary.

C—5 to 20 inches, red (2.5YR 5/6) clayey shale; common light-gray mottles; massive; calcareous; moderately alkaline.

The solum ranges from 3 to 8 inches in thickness.

The A1 horizon is reddish brown, yellowish red, or red.

The C horizon is olive, red, or blue.

Latom Series

The Latom series consists of very shallow to shallow, sloping to moderately steep loamy soils on uplands. The soils formed in a thin layer of loamy material weathered from sandstone.

In a representative profile the surface layer is reddish-brown fine sandy loam about 8 inches thick. Reddish-brown, strongly cemented sandstone is at a depth of 8 inches.

These soils are well drained and moderately permeable. Runoff is rapid, and available water capacity is low.

Representative profile of Latom fine sandy loam in an area of Latom-Owens complex, 5 to 20 percent slopes, 1.5 miles north via Farm Road 1634 from its intersection with U.S. Highway 277 at the west edge of Wichita Falls, Texas, then

0.7 mile east on paved county road and 100 feet south, in an area of range:

A1—0 to 8 inches, reddish-brown (2.5YR 5/4) fine sandy loam, dark reddish brown (2.5YR 3/4) moist; weak, fine, subangular blocky structure; soft, very friable; many sandstone fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

R—8 to 20 inches, reddish-brown (2.5YR 5/4), strongly cemented, calcareous sandstone; contains strata of pale-red (2.5YR 6/2) sandstone; thin, discontinuous coatings of calcium carbonate in crevices.

The A horizon is reddish brown, light brown, or brown and is 4 to 14 inches thick.

A C horizon of partly weathered sandstone, 2 to 6 inches thick, is in some profiles.

The R layer is red, reddish brown, reddish yellow, light brown, pale brown, or light gray.

Latom-Owens complex, 5 to 20 percent slopes (LaE).—This mapping unit is on long, narrow escarpments, mainly to the south of the Wichita River. Areas range from 8 to 160 acres in size. Slopes dominantly range from 5 to 10 percent.

About 40 percent of this mapping unit is Latom soils, 19 percent is Owens soils, and 41 percent is other soils and sandstone outcrop. The areas of soils are too small and too intermingled to be separated at the scale mapped. The range in percentage composition is Latom soils, 35 to 50 percent; Owens soils, 15 to 30 percent; and other soils and sandstone outcrop, 20 to 45 percent.

A Latom soil in this complex has the profile described as representative of the Latom series. It is on the upper areas of this mapping unit. Slopes dominantly range from 5 to 15 percent.

An Owens soil in this complex has a surface layer of reddish-brown clay about 4 inches thick. Below this layer is about 12 inches of reddish-brown, very firm clay. The underlying material is red and olive-gray clayey shale. This soil is mainly below the Latom soil on the steeper areas of the mapping unit. Slopes dominantly range from 8 to 20 percent.

Included with this mapping unit are outcrops of sandstone, which make up about 12 percent of the unit. Areas of Oben, Bluegrove, Cobb, and Vernon soils are also included.

The hazard of water erosion is severe on this complex. All of the acreage of this complex is in native range. This unit is suited only to use as range, wildlife habitat, and recreational areas. Conservative use of grasses on these soils is needed to help control further erosion. Rest periods from grazing are needed if the vigor of grasses is low. Careful consideration is also needed in locating roads and other improvements where traffic by livestock or vehicles may cause loss of soil. Capability unit VIIs-1, dryland; Latom soils, Very Shallow range site; Owens soils, Shallow Clay range site.

Latom-Urban land complex, 5 to 20 percent slopes (LcE).—This mapping unit is mostly in the central part of the Wichita Falls area. It is on long, narrow escarpments south of the Wichita River. Areas range from 15 to about 450 acres in size. Slopes dominantly range from 5 to 15 percent.

About 22 percent of this unit is Latom soils, 45 percent is Urban land, and 33 percent is other soils and sandstone outcrop. Soil areas are too small and too intermingled to be separated at the scale mapped.

Latom soils have a surface layer of reddish-brown fine sandy loam about 10 inches thick over reddish-brown, strongly cemented sandstone.

Urban land consists of works and structures, mostly commercial buildings, parking lots, streets, driveways, sidewalks, and houses. Because of steepness of slopes, the areas have been altered greatly during construction. Leveling for construction requires that deep cuts and fills be made.

Included with this unit in mapping are areas of Oben, Bluegrove, and Vernon soils.

Sandstone outcrops also are included.

Among the limitations to use of this complex for urban development are steepness of slopes, soil changes within short distances, and sandstone layers and boulders on the surface. Not assigned to a capability unit or to a range site.

Lincoln Series

The Lincoln series consists of deep, nearly level to gently sloping loamy soils on bottom lands. The soils formed in recent alluvium.

In a representative profile the surface layer is fine sandy loam about 12 inches thick; it is light brown in the upper 6 inches and light reddish brown below. The underlying material is 48 inches or more of pink fine sand that contains strata of silt loam, clay loam, and fine sandy loam.

These soils are somewhat excessively drained and rapidly permeable. Runoff is slow, and available water capacity is low. Depth to the water table is 3 to 6 feet.

Representative profile of Lincoln fine sandy loam, about 7 miles north on Texas Highway 25 from Haynesville, Texas, then 0.2 mile north and 0.9 mile west on county road from the end of Texas Highway 25, and 35 feet south, in a pasture:

Ap—0 to 6 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, fine, granular structure; slightly hard, very friable; many roots; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 12 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) moist; weak, fine, subangular blocky structure; slightly hard, very friable; common roots; calcareous; moderately alkaline; clear, smooth boundary.

C—12 to 60 inches, pink (5YR 7/4) fine sand, light reddish brown (5YR 6/4) moist; single grained; loose; contains strata of silt loam, clay loam, and fine sandy loam 1/8 to 1 inch thick; bedding planes are evident; saturated at a depth of 60 inches; calcareous; moderately alkaline.

The A horizon is fine sand to clay loam that is light reddish brown, reddish brown, light brown, brown, or grayish brown. It ranges from 6 to 15 inches in thickness.

The C horizon is loamy fine sand to fine sand that contains strata of clay loam to fine gravel. It is reddish brown, reddish yellow, light reddish brown, yellowish red, strong brown, or pink.

Lincoln fine sandy loam (Ln).—This nearly level to gently sloping soil is mainly on flood plains. It has the profile described as representative of the series. Areas range from about 10 to 150 acres in size. In most places they are much longer than they are wide and are almost parallel to the river channel. Slopes range from 0 to about 2 percent.

Included with this soil in mapping are narrow bands of Yahola and Clairemont soils, on slightly higher parts of the flood plain. A few areas of Lincoln soils that have a surface layer of very fine sandy loam or loamy fine sand are also included.

The hazard of soil blowing is moderate, and the hazard of water erosion is slight on this soil.

About 20 percent of the acreage of this Lincoln soil is cultivated. It is mostly in hay and grazing crops, such as sudan, sorghum, winter peas, and bermudagrass. It is better suited to range or bermudagrass pasture than to other purposes. Bermudagrass responds well to applications of fertilizer (fig. 11).

Depth to the water table varies with rainfall, but it is within 4 to 6 feet of the surface most of the time. Most areas of this soil are subject to occasional flooding. Some areas, however, are high enough or are separated from the river channel by narrow bands of Tivoli soils and are seldom if ever flooded. Some areas are slightly to moderately saline,

especially where the water table is within 4 or 5 feet of the surface.

Figure 11.—A good stand of coastal bermudagrass on an area of Lincoln fine sandy loam.

If this soil is cultivated, leaving crop residue on or near the surface helps to control erosion. A large part of the crop rotation should be crops that leave a large amount of residue on the surface, such as small grain, grasses, or sorghum. Some fertilizer is needed. Capability unit IIIe-7, dryland; Sandy Bottomland range site.

Lincoln soils, frequently flooded (Lw).—This nearly level to gently sloping mapping unit is on flood plains. Areas range from about 10 to several hundred acres in size and parallel the river channel. Slopes are dominantly less than 1 percent but range to about 2 percent. Channels in the river dissect or separate areas of Lincoln soils in many places, giving the areas a braided effect. Areas are not uniform.

The surface layer is light reddish-brown loamy fine sand about 10 inches thick. The underlying material, to a depth of 60 inches, is pink fine sand that contains strata of loamy fine sand, silt loam, and sandy loam (fig. 12).

Included with this unit in mapping are small areas of Tivoli soils that have been deposited by the wind in narrow bands, mainly along old secondary stream channels, or on benches separating different levels of the flood plains. Also included are narrow areas of Yahola soils, which generally occupy slightly higher positions on the flood plains than this Lincoln soil. Some soils in slight depressions that have a surface layer of clay or silty clay are also included.

The hazard of soil blowing is moderate on these soils.

Most of the acreage of this unit is used as range, but a few areas are used for hay crops and bermudagrass pasture. The unit is better suited to range or to pasture than to other uses, because of the hazards of flooding, salinity, and soil blowing.

Depth to the water table varies with rainfall, but it is within 3 to 6 feet of the surface most of the time. Most areas of these soils are occasionally to frequently flooded; the frequency of flooding ranges from once every 2 or 3 years to 2 to 3 times each year (fig. 13). Some areas are saline, especially where the water table is within 3 or 4 feet of the surface.

This unit is suitable for use as range, recreational areas, and wildlife habitat. It supports a good growth of useful native grasses. Good management consists of proper grazing practices and control of brush. Woody species that provide suitable habitat for wildlife need to be retained. Capability unit Vw-2, dryland; Sandy Bottomland range site.

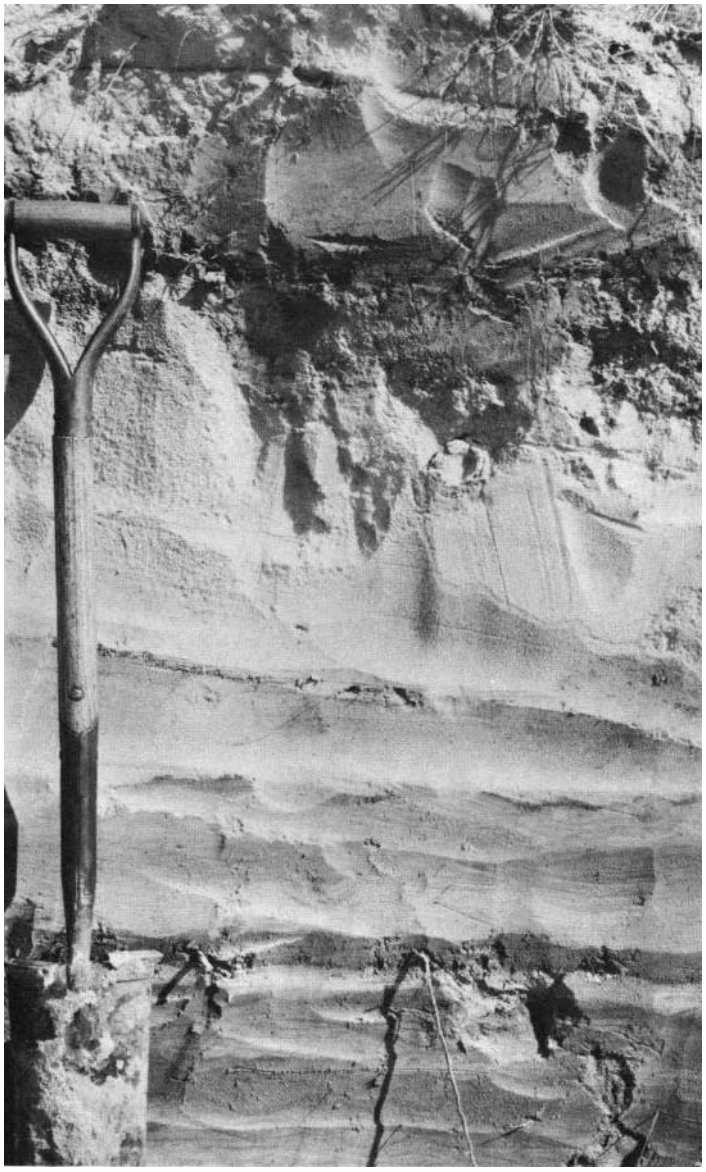


Figure 12.—Profile of Lincoln loamy fine sand.

Mangum Series

The Mangum series consists of deep, nearly level to steep loamy to clayey soils on bottom lands. The soils formed in recent clayey alluvial sediment.

In a representative profile the surface layer is reddish-brown silty clay loam about 7 inches thick. The underlying material, to a depth of 72 inches or more, is reddish-brown clay that contains strata of silty clay loam below a depth of 30 inches.

Most of these soils are well drained, and available water capacity is high. The wet phase is somewhat poorly drained and has medium available water capacity. Runoff is slow on all the soils in this series, and permeability is very slow.

Representative profile of Mangum silty clay loam, 4.2 miles northeast via Farm Road 1740 from its intersection with Farm Road 171, then 0.45 mile southeast on county road, then 2,000 feet northeast along fence line and 50 feet north, in a

cultivated field:

Figure 13.Debris on fence indicates the depth of floodwater on an area of Lincoln soils, frequently flooded.

Ap—0 to 7 inches, reddish-brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak, fine and medium, blocky structure; very hard, firm, sticky; calcareous; moderately alkaline; abrupt, smooth boundary.

C—7 to 72 inches, reddish-brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; massive; extremely hard, very firm; thin strata of silty clay loam that is slightly darker than the material in the other part of the horizon, occur at a depth of about 30 inches; slickensides tilted at 30 to 45 degrees; few films and fine, soft masses of calcium carbonate below a depth of 36 inches; calcareous; moderately alkaline.

The A horizon is silty clay loam or clay that is reddish brown or brown. It ranges from 5 to 10 inches in thickness.

The C horizon is reddish brown, light reddish brown, reddish yellow, yellowish red, light red, or red. The content of clay between depths of 10 and 40 inches ranges from 40 to 60 percent.

Buried horizons that have dark colors and subangular blocky or blocky structure are in some profiles. Strata ranging from loam to silty clay loam are in some areas, mainly at a depth of more than 30 inches. The soils, when dry, have cracks 1 centimeter to 5 centimeters wide that reach to a depth of at least 20 inches. Electrical conductivity ranges from less than 1 millimho to more than 16 millimhos.

Mangum silty clay loam (Ma).—This nearly level soil is on bottom lands along rivers and creeks throughout the county. It has the profile described as representative of the series. Areas are almost parallel to stream channels, and range from about 10 to more than 300 acres in size. Some areas of this soil are on slightly higher parts of the flood plains adjacent to the higher lying soils on terraces or uplands. Slopes are dominantly about 0.5 percent but range from 0.3 to 1 percent.

Included with this soil in mapping are small areas of Mangum clay in low spots and also narrow areas along secondary drainageways. Also included are narrow bands, less than 5 acres, of Clairemont soils that occupy slightly higher positions on the flood plains than this Mangum soil.

The hazards of soil blowing and water erosion are slight on this soil.

About 75 percent of the acreage of this Mangum soil is cultivated. Much of the acreage along the Wichita River is irrigated at least part of the time. Wheat is the major dryland crop. Wheat and bermudagrass are the major irrigated crops. This soil has a high hazard of salinity when irrigated, because of the very slow permeability and the low quality of irrigation water available. Most areas of this soil are flooded occasionally by the main stream channel, but more commonly by tributaries or by runoff received from surrounding soils on terraces or uplands (fig. 14). Some areas are seldom, if ever, flooded. Crop rotation, leaving crop residue on or near the surface, and timely but limited tillage are good management practices.

If this soil is irrigated, crops of medium to high salt tolerance should be used. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that permit effective leaching and most efficient use of rainfall are needed. Capability unit IIw-2, dryland; IIIs-1, irrigated; Draw range site.

Figure 14.—A concrete-lined irrigation ditch on an area of Mangum soil has been severely damaged by floodwater.

Mangum clay (Mc).—This nearly level soil is on bottom lands along rivers and creeks in the county. Areas are mostly long and narrow, but a few are irregular in shape. They range from 10 to 200 acres in size. Slopes range from 0.2 to 1 percent.

The surface layer is reddish-brown clay about 6 inches thick. The underlying material, to a depth of 70 inches, is in several layers. The upper 18 inches is reddish-brown clay, and the next 6 inches is yellowish-red silty clay loam. Below is 28 inches of reddish-brown clay over 12 inches of reddish-brown silty clay loam.

Included with this soil in mapping are spots of Mangum clay loam and Clairemont soils.

The hazards of soil blowing and water erosion are slight on this soil.

About 70 percent of the acreage of this Mangum soil is cultivated, but only about 25 percent is irrigated. Small grain is the major dryland crop. Bermudagrass is the major irrigated crop. Some areas are occasionally flooded, mostly by runoff received from surrounding higher soils. This soil has a medium to high hazard of salinity when irrigated, because of the quality of irrigation water available. Crop rotation, leaving crop residue on or near the surface, and timely but limited tillage are good management practices.

If this soil is irrigated, crops of high salt tolerance should be used. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that permit effective leaching and most efficient use of rainfall are needed. Capability

unit II1w-1, dry-land; IVs-1, irrigated; Clayey Bottomland range site.

Mangum-Fluvent complex, severely eroded (Me).—This gently sloping to steep mapping unit is on eroded areas. It is associated with Mangum clay and silty clay loam along drainageways. The areas are long and narrow and range from 7 to 55 acres in size. About 20 to 30 percent of the areas are noneroded Mangum soils, and the remaining areas are gullies. Slopes range from 3 to 30 percent.

About 40 percent of this unit is Mangum soils, 35 percent is Fluvents, and 25 percent is other soils. The soil areas are too small and too intermingled to be separated at the scale mapped.

The Mangum soils have a surface layer of reddish-brown silty clay about 6 inches thick. The underlying material, to a depth of 60 inches, is reddish-brown clay.

The Fluvents are reddish-brown clay that contains dark-colored strata to a depth of 60 inches.

Included with this unit in mapping are gully bottoms.

The hazard of water erosion is severe on these soils.

All of the acreage of this complex is used as range. Soil profiles have been destroyed except for areas between gullies. Gullies range from 2 to 15 feet in depth. Vegetation on these areas is mostly sparse and in patches. There are many bare areas. This unit is suitable only for use as range, wildlife habitat, and recreational areas. Conservative use of grasses on these soils is needed to help control erosion. Rest periods from grazing are needed if the vigor of grasses is low. Careful consideration is also needed in locating roads and other improvements where traffic by livestock or vehicles are likely to result in loss of soil. Capability unit VIIs-1, dryland; Clayey Bottomland range site.

Mangum-Urban land complex (Mf).—This nearly level mapping unit is on bottom lands, mostly north of the central business district of Wichita Falls, Texas. The areas are irregular in shape and range from 15 to 480 acres in size. Slopes range from 0.3 to about 1 percent.

About 50 percent of this unit is Mangum soils, 45 percent is Urban land, and 5 percent is other soils. Soil areas are too small and too intermingled to be separated at the scale mapped.

A Mangum soil in this complex has a surface layer of reddish-brown silty clay loam about 7 inches thick. The underlying material, to a depth of 80 inches, is in three layers. The upper part is 52 inches of reddish-brown clay over 4 inches of reddish-yellow silty clay loam. The last layer is reddish-brown stratified clay and silty clay loam.

Urban land consists of works and structures, mostly streets, railroads, businesses, schools, houses, driveways, parking lots, and sidewalks. The terrain is flat, and most areas of this complex have not been altered greatly by construction.

Included with this unit in mapping are areas of Clairemont soils.

Among the limitations to use of this complex for urban development are shrink-swell, which causes cracking and shifting of structures (fig. 15); permeability, which contributes to failure of septic tank filter fields; and corrosivity, which results in failure of steel pipelines. Susceptibility to flooding also affects the use of this complex. Not assigned to a capability unit or to a range site.

Mangum soils, wet (Mg).—These nearly level soils are on bottom lands along rivers or creeks, mostly in depressions or along narrow drainageways. Areas range from about 10 to 80 acres in size. Slopes range from 0 to about 1 percent.

The surface layer is reddish-brown clay about 6 inches thick. The underlying material, to a depth of 60 inches, is in three layers. The upper 24 inches is reddish-brown clay. Next is 14 inches of red clay. Below is 16 inches of red silty clay loam that contains strata of clay and very fine sandy loam.

Figure 15.—Shrinking and swelling in an area of Mangum clay caused curb and street to crack and shift.

Included with these soils in mapping are areas of Clairemont soils.

About 75 percent of the acreage of these Mangum soils is cultivated or has been in the past. Bermudagrass is the major crop. These soils either have a water table at a depth of 3 to 6 feet or have restricted surface drainage that keeps them wet for long periods. Most areas are 20 to 95 percent bare, where vegetation will not grow or has been killed out (fig. 16). Both salinity and excess water contribute to poor growth of plants. These soils have a low to very high hazard of salinity because of restricted drainage and leaching. The main concerns of management are to maintain or improve tilth, adapt cropping systems to the soil limitations, and manage water. Leaving crop residue on or near the surface helps to reduce evaporation, which brings harmful salts toward the surface. Mulches such as cotton burs also help to reduce evaporation. Capability unit VIw-1, dryland; IVw-1, irrigated, after drainage; Clayey Bottomland range site.

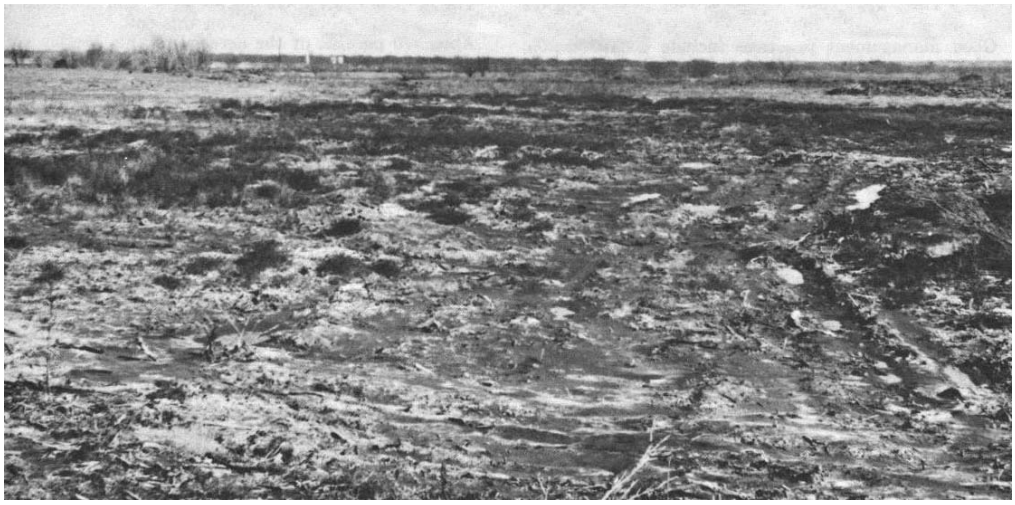


Figure 16.—Typical area of Mangum soils, wet. The water in small areas indicates a high water table.

Motley Series

The Motley series consists of deep, nearly level to gently sloping soils on uplands. The soils formed in loamy, old alluvial sediment.

In a representative profile the surface layer is brown loam about 9 inches thick. Below this layer is 27 inches of reddish-brown, friable sandy clay loam over red, friable sandy clay loam about 14 inches thick. Next is 33 inches of reddish-yellow, friable sandy clay loam. The underlying material is 9 inches or more of reddish-yellow loam.

These soils are well drained and moderately permeable. Runoff is slow to medium, and available water capacity is high.

Representative profile of Motley loam, 1 to 3 percent slopes, 0.55 mile south via Farm Road 369 from its intersection with Texas Highway 240 at the west edge of Burkburnett, then 0.45 mile east on county road and 80 feet north, in a field:

Ap—0 to 9 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable; many roots; neutral; abrupt, smooth boundary.

B1t—9 to 16 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, friable; few faint clay films; many fine and very fine pores; few worm casts; few fine siliceous pebbles; neutral; gradual, smooth boundary.

B21t—16 to 36 inches, reddish-brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak, coarse, prismatic structure parting to moderate, fine and medium, subangular blocky; very hard, friable; thin, patchy clay films on surfaces of peds; common fine pores and many very fine pores; few fine siliceous pebbles; neutral; gradual, smooth boundary.

B22t—36 to 50 inches, red (2.5YR 5/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable; common very fine pores; thin, patchy clay films on surfaces of peds; few fine siliceous pebbles; mildly alkaline; gradual, wavy boundary.

B23t—50 to 68 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; few threads and films and few soft masses of calcium carbonate; few fine siliceous pebbles; calcareous; moderately alkaline; clear, wavy boundary.

B3ca—68 to 83 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure; hard, friable; about 10 percent, by volume, soft masses and concretions of calcium carbonate; few fine siliceous pebbles; calcareous; moderately alkaline; gradual, wavy boundary.

C—83 to 92 inches, reddish-yellow (5YR 6/6) loam, yellowish red (5YR 5/6) moist; massive; slightly hard, friable; few threads and films and few soft masses of calcium carbonate; few siliceous pebbles as much as $^{1}/2$ inch in diameter; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to calcareous material, in the form of films, threads, soft masses, or concretions of calcium carbonate, is 36 to more than 50 inches.

The A horizon is brown or reddish brown and is 6 to 14 inches thick. It is mildly alkaline to neutral.

The B1t horizon is brown or reddish brown and is 4 to 8 inches thick. It is neutral or mildly alkaline.

The B2t horizon is sandy clay loam or clay loam that is reddish brown, yellowish red, or red. It ranges from 24 to 80 inches in thickness and is neutral to moderately alkaline.

A B3 horizon 8 to 20 inches thick is in some profiles. It is reddish brown, yellowish red, reddish yellow, or red. About 2 to 15 percent of this horizon is calcium carbonate in the form of soft masses and concretions. The B3ca horizon is sandy clay loam, loam, or fine sandy loam.

The C horizon is fine sandy loam, loam, or sandy clay loam that is reddish brown, yellowish red, reddish yellow, or red.

Motley loam, 0 to 1 percent slopes (MoA).—This nearly level soil is on uplands. Areas have a plane to weakly concave surface. They are irregular in shape and range from 10 to 130 acres in size. Most areas are less than 50 acres in size.

The surface layer is brown loam about 12 inches thick. Below this layer is about 6 inches of brown, friable sandy clay loam over about 18 inches of reddish-brown, friable sandy clay loam. Next is about 18 inches of yellowish-red, friable sandy clay loam over about 12 inches of reddish-yellow, friable sandy clay loam. Below, to a depth of 80 inches, is yellowish-red, friable sandy clay loam.

Included with this soil in mapping are small areas, less than 5 acres, of Rotan and Tipton soils, which are at slightly lower elevations on the landscape than this Motley soil. Also included are narrow areas of soils that have slopes of slightly more than 1 percent.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Motley soil is cultivated. Wheat is the major crop. Some alfalfa, winterpeas, cotton, and grain sorghum are also grown. The soil is well suited to all dryland crops grown in the area. Conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. The cropping system should include sorghum, small grain, and other crops that leave a large amount of residue on or near the surface. Terraces help in conserving water. Capability unit IIc-2, dryland; Mixedland range site.

Motley loam, 1 to 3 percent slopes (MoB).—This gently sloping soil is on uplands. It has the profile described as representative of the series. Areas have a plane to convex surface. They are irregular in shape and range from 10 to several hundred acres in size. Slopes are dominantly about 2.5 percent.

Included with this soil in mapping are areas, less than 5 acres, of Rotan and Tipton soils, which are in low spots or near the heads of natural drainageways. Also included are small areas of soils that have a combined surface layer and subsoil less than 60 inches thick.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About 85 percent of the acreage of this Motley soil is cultivated. Wheat is the major crop. Some alfalfa, winterpeas, cotton, and sorghum are also grown. The soil is well suited to most crops grown in the area. A few shallow gullies and rills are in some unprotected cultivated areas, especially along natural drainageways or other areas where runoff concentrates (fig. 17).

Good management practices include crop rotation, leaving crop residue on or near the surface, and limited but timely tillage. Contour cultivation, along with the use of terraces, is necessary to help control water erosion. In places diversion terraces and grassed waterways are needed for safe disposal of runoff water. Capability unit IIe-1, dryland; Mixedland range site.

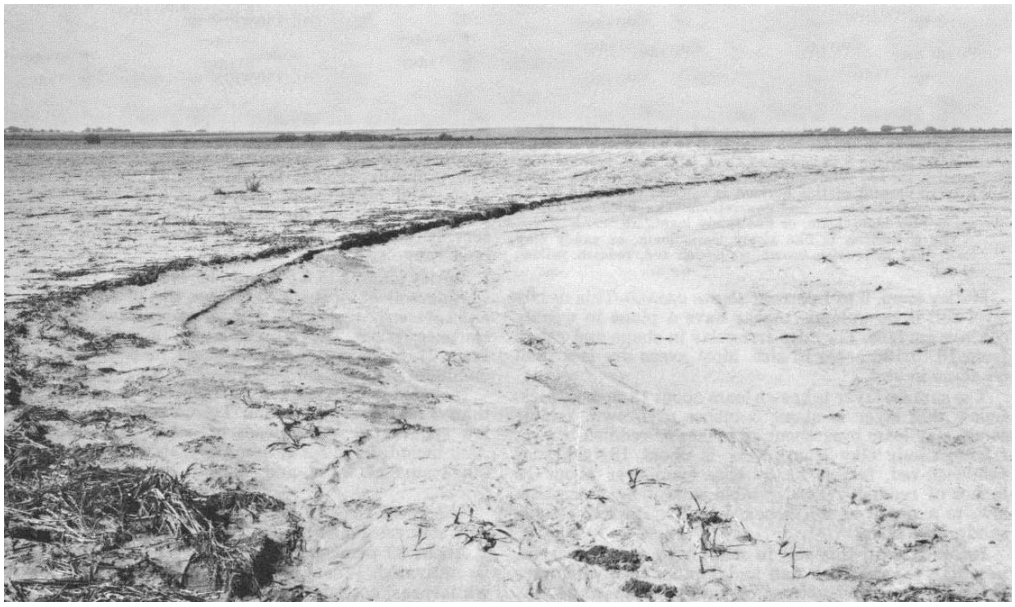


Figure 17.—Water erosion in an area of Motley loam, 1 to 3 percent slopes.

Motley loam, 3 to 5 percent slopes (MoC).—This gently sloping soil is on uplands. Areas have a plane to convex surface. They are longer than they are wide, and are on hilltops or on side slopes flanking natural drainageways. Areas range from about 5 to 80 acres but are mainly less than 40 acres in size. Slopes are dominantly about 3 to 4 percent.

The surface layer is reddish-brown loam about 6 inches thick. Below is about 20 inches of reddish-brown, friable sandy clay loam over yellowish-red, friable sandy clay loam to a depth of 96 inches.

Included with this soil in mapping are small areas, less than 5 acres, of Enterprise soils that are in narrow bands on ridge crests. Also included are small areas of soils that have slopes of 1 to 3 percent. Also included and making up about 15 percent of the mapped areas are soils that are underlain by sandstone or clayey red beds at a depth of 48 to 60 inches.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About 70 percent of the acreage of this Motley soil is cultivated. Wheat is the major crop. Some winterpeas, sorghum, oats, and barley are also grown. A few shallow gullies, crossable with tillage implements and more than 300 feet apart, are in some unprotected cultivated areas.

Good management practices include leaving crop residue on or near the surface, timely but limited tillage, and contour cultivation, used along with terraces. This soil responds to applications of fertilizer. Capability unit IIIe-5, dryland; Mixedland range site.

Oben Series

The Oben series consists of shallow, gently sloping, loamy soils on uplands. The soils formed in medium-grained sandstone.

In a representative profile the surface layer is dark-brown fine sandy loam about 6 inches thick. Below this layer is reddish-brown and strong-brown, friable sandy clay loam about 11 inches thick. The underlying material is 19 inches or more of interbedded, reddish-brown and gray, weakly cemented sandstone.

These soils are well drained and moderately permeable. Runoff is medium, and available water capacity is low.

Representative profile of Oben fine sandy loam, 1 to 5 percent slopes, 3 miles southeast via U.S. Highway 287 from its intersection with Texas Highway 25 on the north edge of Electra, then 1.05 miles north on paved county road and 750 feet east, in an area of range:

A1—0 to 6 inches, dark-brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak, fine, granular structure; slightly hard, friable; neutral; clear, smooth boundary.

B21t—6 to 12 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine, subangular blocky structure; hard, friable; few, thin, continuous clay films; neutral; clear, wavy boundary.

B22t—12 to 17 inches, strong-brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; weak to moderate, fine, subangular blocky structure; hard, friable; few, thin, patchy clay films; few fragments of weakly cemented sandstone; neutral; abrupt, wavy boundary.

C—17 to 36 inches, interbedded reddish-brown and gray, weakly cemented sandstone; few thin strata of clayey red beds.

The A horizon is dark brown, brown, or reddish brown and is 4 to 7 inches thick. It is slightly acid or neutral.

The Bt horizon is loam or sandy clay loam that is reddish brown, yellowish red, brown, or strong brown. It ranges from 6 to 15 inches in thickness and is slightly acid or neutral.

The C horizon is at a depth of 10 to 20 inches. It is weakly cemented to strongly cemented sandstone that is reddish brown, red, reddish yellow, or strong brown.

Oben fine sandy loam, 1 to 5 percent slopes (ObC).—This gently sloping soil is on ridges and knobs. The areas have a convex surface. They are small, ranging mostly from 5 to 50 acres in size. Slopes are dominantly about 3 percent.

Included with this soil in mapping and making up about 10 percent of the unit are areas of Cobb and Bluegrove soils. Also included and making up about 5 percent of the unit are areas of Vernon soils that are on the lower parts of side slopes. About 15 to 20 percent of the included soils are redder in the subsoil.

The hazards of soil blowing and water erosion are moderate on this soil.

Most of the acreage of this Oben soil is used as range. Good management practices include proper control of grazing, rest periods from grazing during the growing season, and control of brush as needed. Crops that leave a large amount of residue on or near the surface, such as small grain and sorghum, should be grown. Contour cultivation, along with the use of terraces, is needed. Capability unit IVe-3, dryland; Sandy Loam range site.

Oil Wasteland

Oil wasteland (Oe) is mainly along small drainageways and tributaries, but a few areas are on upland flats. It consists of areas in which liquid waste from oil wells and drilling operations, chiefly oil and salt water, has accumulated. Some of these areas are elongated, and others are irregular in shape. They range from 5 to 100 acres but average about 15 acres. Slopes are 0.5 to 10 percent.

Included with this land type in mapping are small areas of Tillman, Deandale, Kamay, and Vernon soils.

The areas of these soils are 1 to 3 feet higher than those of Oil wasteland.

Most areas of Oil wasteland are severely eroded because of a lack of vegetation. They occur mainly in areas of Deandale, Kamay, Tillman, and Vernon soils but to a minor extent in areas of other soils. In most places the original surface layer has been lost, and the present surface layer is clay. Electrical conductivity of the upper 6 inches ranges from 10 millimhos to more than 100 millimhos.

About 85 to 100 percent of the areas lack a plant cover. Runoff from these areas is rapid. Establishing vegetation is difficult and in most places is impractical (fig. 18). Capability unit VIIIs-1, dryland; not assigned to a range site.

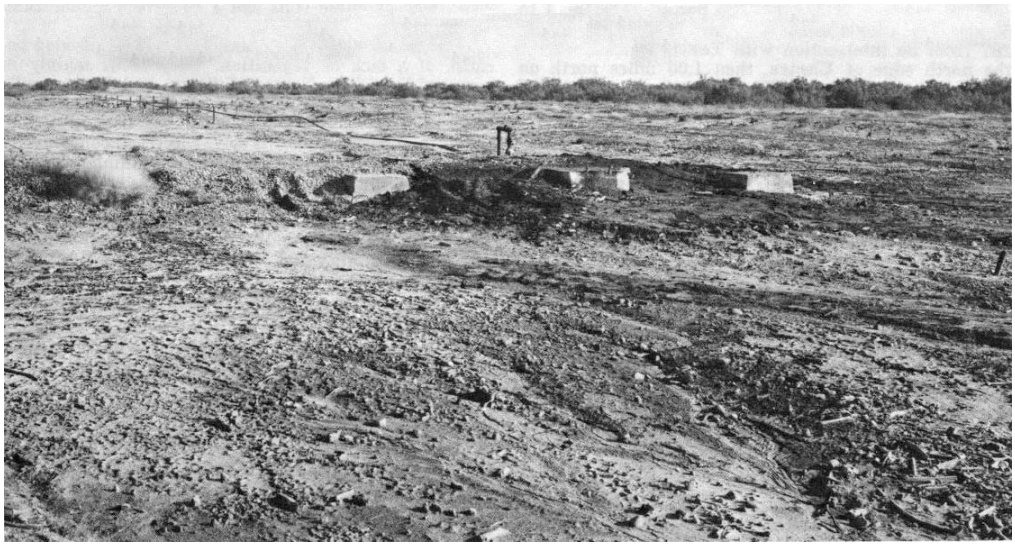


Figure 18.—An area of Oil wasteland that is almost bare of vegetation.

Owens Series

The Owens series consists of shallow, gently sloping to steep, clayey soils on uplands. The soils formed in red-bed clay and shale.

In a representative profile the surface layer is reddish-brown clay about 6 inches thick. Below this layer is 8 inches of red, very firm clay. The underlying material is 22 inches or more of interstratified olive-gray and red, clayey shale.

These soils are well drained and very slowly permeable. Runoff is rapid, and available water capacity is low.

Representative profile of Owens clay in an area of Owens-Knoco complex, 3 to 15 percent slopes, 2.25 miles south via Texas Highway 25 from its intersection with U.S. Highway 287 Business, in Electra, then 300 feet west to Turkey Triangulation Station and 0.6 mile southwest, in an area of range:

A1—0 to 6 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak, medium, subangular blocky structure; very hard, very firm; sticky; many hardened lime-coated shale fragments on surface, a few range from 2 millimeters to 5 inches in size; calcareous; moderately alkaline; gradual, smooth boundary.

Bca—6 to 14 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium, blocky structure; extremely hard, very firm; sticky; few films of calcium carbonate; few flakes of olive-gray shale; few hardened shale fragments; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—14 to 28 inches, interstratified olive-gray (5Y 4/2) and red (2.5YR 4/6), fractured, clayey shale; massive; few roots between shale fragments; about 10 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C2—28 to 36 inches, red (2.5YR 4/6), fractured, massive, clayey shale; strata of olive gray (5Y 42); calcareous; moderately alkaline.

The solum ranges from 12 to 20 inches in thickness.

The A horizon is clay loam or clay that is reddish brown, red, brown, or grayish brown. It ranges from 3 to 10 inches in thickness.

The Bca horizon is red, weak red, reddish brown, yellowish red, reddish yellow, brown, olive gray, or light olive gray and is 4 to 14 inches thick.

The C horizon is clay or clayey shale that is weak red, red, reddish brown, olive gray, or light olive gray and is mostly interstratified with two or more of these colors.

Owens stony clay, 5 to 30 percent slopes (OsF).—This sloping to steep soil is on escarpment-type breaks near rivers and large creeks. Areas are long and narrow. About 25 percent of the surface is covered with loose limestone or sandstone rock, which has fallen from strata on the upper side of the escarpment (fig. 19).

Figure 19.—Large rocks scattered on the surface of an area of Owens stony clay, 5 to 30 percent 2slopes.

The surface layer is reddish-brown clay about 4 inches thick. Below this layer is about 12 inches of reddish-brown, very firm clay. The underlying material, to a depth of 60 inches or more, is weak-red clayey shale.

Included with this soil in mapping are small areas of Latom, Vernon, and Oben soils. Areas of soils that have slopes of more than 30 percent are also included.

The hazard of water erosion is severe on this soil.

All of the acreage of this Owens soil is in native range. This soil is suitable only for use as range, wildlife habitat, and recreational areas. Conservative use of grasses on this soil helps to control erosion. Rest periods from grazing are needed if the vigor of grasses is low. Careful consideration is also needed in locating roads and other improvements where traffic by livestock or vehicles is likely to result in loss of soil. Capability unit VIIs-1, dryland; Rocky Hills range site.

Owens-Knoco complex, 3 to 15 percent slopes (OwE).—This gently sloping to moderately steep complex is in irregularly shaped areas that contain many gullies. The drainage pattern is well defined, and runoff water is carried quickly from these areas. Areas range from 8 to several hundred acres in size, but most areas are more than 25 acres in size. Much of the surface is covered with hardened shale fragments and quartz pebbles that range from 2 millimeters to 10 inches in size (fig. 20).

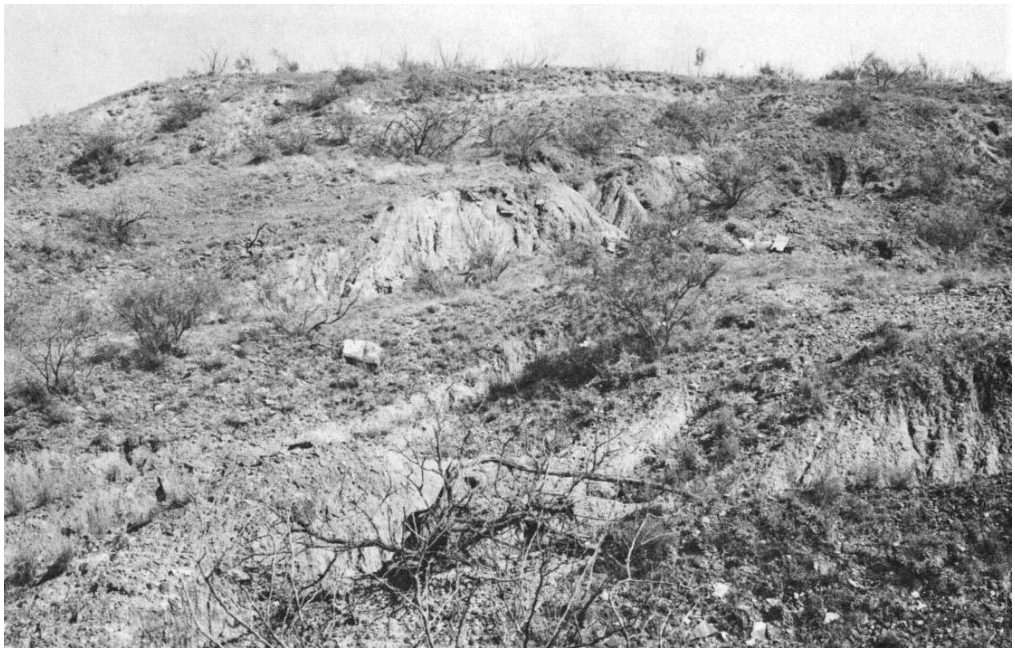


Figure 20.—Gullies and uneven topography on an area of Owens-Knoco complex, 3 to 15 percent slopes.

About 44 percent of this complex is Owens soils, 28 percent is Knoco soils, and 28 percent is other soils. Soil areas are too small in size and too intermingled to be separated at the scale mapped. The range in percentage composition is Owens soils, 35 to 60 percent; Knoco soils, 10 to 55 percent; and other soils, 8 to 45 percent.

An Owens soil in this complex has the profile described as representative for the Owens series. It is on the smoother, more convex, and sparsely vegetated to better vegetated part of the complex.

A Knoco soil in this complex has the profile described as representative of the Knoco series. It is on narrow ridges, divides, and steep side slopes.

Included with this complex in mapping are narrow strips of Mangum soils. Also included are areas of Vernon, Latom, and Tillman soils.

The hazard of water erosion is severe.

All of the acreage of this complex is in native range. This unit is suitable only for use as range, wildlife habitat, and recreational areas. Conservative use of grasses on these soils is needed to help control erosion. Rest periods from grazing are needed if the vigor of grasses is low. Careful consideration is also needed in locating roads and other improvements where traffic by livestock or vehicles is likely to result in loss of soil. Capability unit VIIs-1, dryland; Shallow Clay range site.

Port Series

The Port series consists of deep, nearly level, loamy soils on bottom lands. The soils formed in calcareous alluvium.

In a representative profile the surface layer is brown silt loam about 24 inches thick. Below is 34 inches of reddish-brown, firm silty clay loam over 32 inches of light brownish-gray silty clay.

These soils are well drained and moderately permeable. Runoff is slow, and available water capacity is high.

Representative profile of Port silt loam, 0.85 mile east via U.S. Highway 287 Business from its intersection with Farm Road 1814 on the east edge of Iowa Park, then 100 feet north, in a cultivated field:

Ap—0 to 7 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak, medium, granular structure; slightly hard, friable; slightly acid; clear, smooth boundary.

A1—7 to 24 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; moderate, medium, granular structure; slightly hard, friable; many fine and medium pores; many worm casts; neutral; clear, smooth boundary.

B21—24 to 30 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, firm; strata of silt loam and very fine sandy loam; faint bedding planes; many fine pores; many worm casts; neutral; clear, smooth boundary.

B22—30 to 58 inches, reddish-brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate, medium, subangular blocky structure; hard, firm; many fine pores; strata of silt loam and very fine sandy loam in upper part; neutral; abrupt, smooth boundary.

Ab—58 to 90 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; very hard, very firm; common films and threads of calcium carbonate; calcareous; moderately alkaline.

Depth to carbonates is 30 to 60 inches.

The A horizon is dark brown, brown, dark grayish brown, or grayish brown and is 20 to 40 inches thick. It is slightly acid to mildly alkaline. In the lower 2 to 4 inches in some profiles, peds have a gray powdery coating.

The B horizon is silt loam, clay loam, or silty clay loam that is reddish brown, dark reddish brown, brown, dark brown, or grayish brown. Most profiles contain strata of silt loam, very fine sandy loam, or fine sandy loam. This horizon is neutral to moderately alkaline and is calcareous in places.

A C horizon is at a depth of 35 to 75 inches in some profiles. It is very fine sandy loam to silty clay that is reddish brown, light yellowish brown, reddish yellow, or yellowish red.

Port silt loam (Po).—This nearly level soil is on bottom lands along the larger creeks. Most areas are elongated and are parallel to the stream channels. Areas range from 15 to several hundred acres in size. Slopes range from about 0 to 1 percent.

Included with this soil in mapping are areas of Clairemont and Mangum soils. About 30 percent of the areas of this soil have carbonates leached below a depth of 60 inches.

The hazards of soil blowing and water erosion are slight on this soil.

About 75 percent of the acreage of this Port soil is used as range. Some areas are occasionally flooded, but the water remains only for a few hours. This soil is suited to most dryland and irrigated crops grown in the county. Irrigated areas of this soil have a moderate hazard of salinity, and crops of medium and high salt tolerance are better

suited. Because of the low quality of irrigation water available, this soil requires occasional leaching to keep salt accumulations at a safe level. Surface irrigation systems that permit effective leaching and most efficient use of rainfall are needed. Conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. Capability unit IIw-1, dryland; IIs-1, irrigated; Loamy Bottomland range site.

Renfrow Series

The Renfrow series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in material weathered from clay or clayey shale.

In a representative profile the surface layer is brown loam about 5 inches thick. Below this layer is 7 inches of reddish-brown, firm clay loam over reddish-brown and red, very firm clay about 56 inches thick; next is dark-red, very firm clay about 28 inches thick. The underlying material is 14 inches or more of dark-red clay mottled with olive (fig. 21).

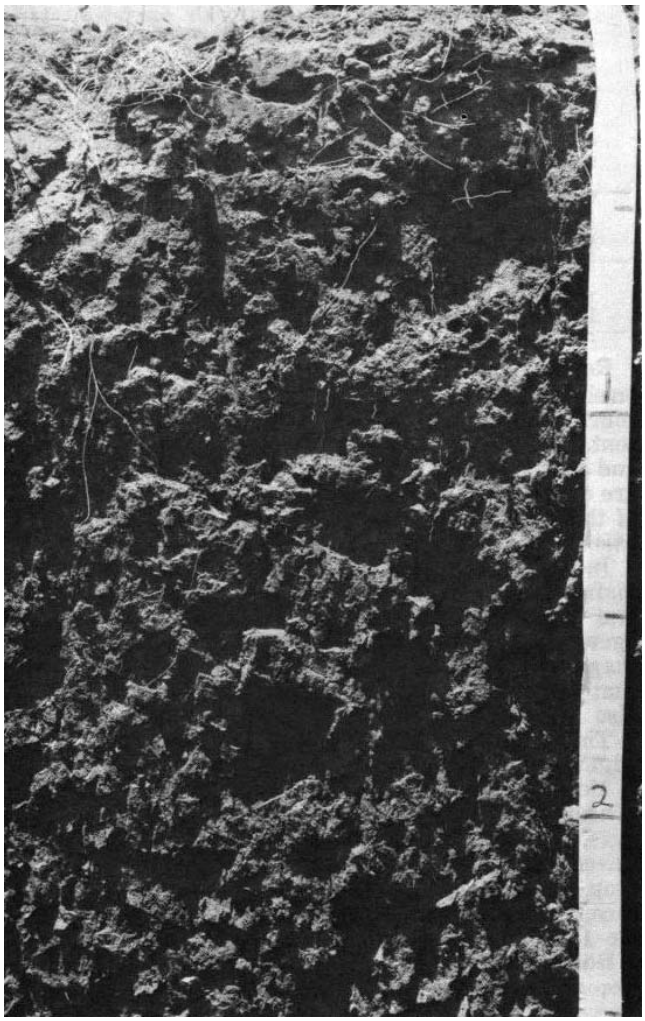


Figure 21.—Profile of Renfrow loam, 1 to 3 percent slopes. The blocky structure begins at a depth of about 12 inches.

These soils are well drained and very slowly permeable. Runoff is slow to medium, and available water capacity is high.

Representative profile of Renfrow loam, 1 to 3 percent slopes, 2.16 miles south via Windthorst Road from its intersection with U.S. Highway 287, then 400 feet west, in an area of range:

A1—0 to 5 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; hard, friable; neutral; abrupt, smooth boundary.

B1t—5 to 12 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate, fine, subangular blocky structure; hard, firm; common fine pores; common worm casts; few, thin, patchy clay films; neutral; clear, smooth boundary.

B21t—12 to 34 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; strong, medium, blocky structure; very hard, very firm; few iron-manganese concretions; cracks, 1/8 to 1/2 inch wide, filled with loam; continuous distinct clay films; few short slickensides in lower part; mildly alkaline; diffuse, wavy boundary.

B22t—34 to 48 inches, reddish-brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, very firm; few calcium carbonate concretions; cracks filled with loam; continuous distinct clay films; few short slickensides; mildly alkaline; diffuse, wavy boundary.

B23tca—48 to 68 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate, fine and medium, subangular blocky structure; very hard, very firm; about 15 percent, by volume, soft masses and concretions of calcium carbonate; few cracks filled with loam; discontinuous thin clay films; calcareous; moderately alkaline; diffuse, wavy boundary.

B24t&C—68 to 96 inches, dark red (10YR 3/6) clay, 20 percent mottled with olive (5Y 5/3) clay; moderate, medium and coarse, blocky structure; very hard, very firm; noncalcareous; moderately alkaline; diffuse, wavy boundary.

C—96 to 110 inches, dark-red (10R 3/6) clay, 50 percent of mass mottled with olive (5Y 5/3); noncalcareous; moderately alkaline.

The solum ranges from 60 to more than 90 inches in thickness. Depth to carbonates ranges from 28 to more than 60 inches.

The A1 horizon is brown, dark brown, or reddish brown and is 5 to 9 inches thick. It is slightly acid or neutral in reaction.

The B1t horizon is brown, dark brown, or reddish brown. It ranges from 3 to 10 inches in thickness and is slightly acid to mildly alkaline.

The B21t horizon ranges from 5 to 12 inches in thickness.

The B2t horizon is clay loam or clay that is reddish brown, dark brown, brown, dark red, yellowish red, or red. It is mildly alkaline or moderately alkaline.

The C horizon is generally mottled clay or clayey shale that is red, dark red, gray, or olive.

Renfrow loam, 0 to 1 percent slopes (ReA).—This nearly level soil is on upland areas that have a plane to weakly convex surface. Areas range from 50 to 200 acres in size. Slopes are dominantly about 1.8 percent.

The surface layer is reddish-brown loam about 6 inches thick. Below this layer is about 3 inches of reddish-brown, firm loam over about 55 inches of reddish-brown and red, very firm clay. Next, to a depth of 80 inches, is red, yellow, and olive clayey shale.

Included with this soil in mapping are areas of Kirkland, Tillman, and Bluegrove soils. Also included, and making up about 35 percent of the unit, is a soil that is similar to this Renfrow soil except that carbonates are not leached below a depth of 28 inches.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Renfrow soil is used as range. Wheat is the major cultivated crop. This soil is not suitable for irrigation with the quality of irrigation water available. Leaving crop residue on or near the surface helps to control evaporation of moisture, to increase moisture penetration, and to maintain the supply of organic matter. Capability unit IIs-1, dryland; Claypan Prairie range site.

Renfrow loam, 1 to 3 percent slopes (ReB).—This gently sloping soil is on upland areas that have a weakly convex surface. It has the profile described as representative of the series. Areas range from 50 to 200 acres in size.

Included with this soil in mapping are areas of Kirkland, Bluegrove, Kamay, and Tillman soils. Also included, and making up about 35 percent of the unit, is a soil that is similar to this Renfrow soil except that the carbonates are not leached below a depth of 28 inches.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

Most of the acreage of this Renfrow soil is used as range. A few small areas are cultivated, and wheat is the major crop. This soil is too droughty for summer tillage and is better suited to cool-season crops, such as small grain. Leaving crop residue on or near the surface and farming in the contour, along with the use of terraces, help to control water erosion and cut down on evaporation of moisture. Capability unit IIIe-2, dryland; Claypan Prairie range site.

Renfrow-Urban land complex, 0 to 3 percent slopes (RfB).—This nearly level to gently sloping mapping unit is on uplands in the southeastern part of the Wichita Falls area. Areas range from about 50 to 100 acres in size. Slopes are dominantly about 2.5 percent.

About 35 percent of this unit is Renfrow soils, 55 percent is Urban land, and 10 percent is other soils. The areas are too small and too intermingled to be separated at the scale mapped.

Renfrow soils have a surface layer of dark-brown loam about 8 inches thick. Below this layer is reddish-brown and yellowish-red, very firm clay about 32 inches thick. Next, to a depth of 78 inches, is reddish-brown, very firm clay that has olive mottles.

Urban land consists of works and structures, mostly houses, streets, driveways, sidewalks, commercial buildings, parking lots, and railroads. The terrain is flat, and many of the areas have not been altered greatly by construction.

Included with this complex in mapping are areas of Kirkland, Kamay, Bluegrove, and Tillman soils.

Among the limitations to use of this complex for urban development are shrink-swell, which causes cracking and shifting of structures; permeability, which contributes to failure of septic tank filter fields; and corrosivity, which results in failure of steel pipelines. Not assigned to a capability unit or to a range site.

Rotan Series

The Rotan series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in old, calcareous alluvial sediment.

In a representative profile the surface layer is brown loam about 10 inches thick. Below this layer is 8 inches of dark grayish-brown, firm clay loam over 30 inches of dark-brown and brown, firm clay. Next is reddish-brown, firm clay about 22 inches thick over 20 inches of reddish-brown, firm clay loam.

These soils are well drained and moderately slowly permeable. Runoff is slow to medium, and available water capacity is high.

Representative profile of Rotan loam, 0 to 1 percent slopes, 2 miles west of Haynesville via Texas Highway 240, then 4.1 miles north on county road, then 60 feet west, in a cultivated field:

Ap—0 to 10 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

B21t—10 to 18 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, firm; many fine and very fine pores; thin clay films on surfaces of peds; few worm casts; mildly alkaline; gradual, smooth boundary.

B22t—18 to 27 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium, blocky structure; very hard, firm; common very fine pores; distinct, almost continuous clay films on surfaces of peds; mildly alkaline; gradual, smooth boundary.

B23t—27 to 48 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate, medium, blocky structure; very hard, firm; few fine pores; distinct, almost continuous clay films; few, small, strongly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—48 to 70 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate, fine to medium, subangular blocky structure; very hard, firm; 5 to 10 percent, by volume, soft masses and strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3—70 to 90 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak, fine to medium, subangular blocky structure; hard, firm; films and a few, small, strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 90 inches in thickness. Depth to carbonates ranges from 10 to 38 inches.

The A horizon is brown, dark brown, dark grayish brown, or grayish brown and is 6 to 10 inches thick. It is neutral or mildly alkaline.

The B2t horizon is clay loam to clay that is dark brown, brown, dark grayish brown, or reddish brown. It ranges from 38 to more than 60 inches in thickness and is mildly or moderately alkaline. Its structure ranges from moderate, fine, subangular blocky to moderate, medium, blocky.

The B2tca and B3 horizons are clay loam or clay that is reddish brown, yellowish red, reddish yellow, pink, red, or light red. They contain 15 to 20 percent, by volume, calcium carbonate in the form of films, soft masses, or concretions.

Rotan loam, 0 to 1 percent slopes (RoA).—This nearly level soil is on upland areas that have a plane to weakly concave surface. It has the profile described as representative of the series. Areas are irregular in shape and range from about 10 to 200 acres in size. Slopes are dominantly less than 0.5 percent. About 60 percent of the areas of this soil contain concretions of calcium carbonate at a depth of more than 28 inches.

Included with this soil in mapping are small areas, mainly less than 5 acres in size, of Frankirk, Tipton, and Motley soils. These soils are along natural drainageways or are on slightly higher parts of the landscape than this Rotan soil. Small areas of Rotan soils that have slopes of slightly more than 1 percent are also included.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Rotan soil is cultivated. Wheat is the major crop, but some oats, cotton, winterpeas, and other crops are also grown. This soil is well suited to cultivation. Good management practices are crop rotation, leaving crop reside on or near the surface, and timely but limited tillage. Capability unit IIc-1, dryland; Clay Loam range site.

Rotan loam, 1 to 3 percent slopes (RoB).—This gently sloping soil is on areas that have a plane to weakly convex surface. Areas are irregular in shape and range from about 20 to 180 acres in size. Slopes are dominantly about 1.5 percent. About 55 percent of the areas of this soil have concretions of calcium carbonate at a depth of more than 28 inches.

The surface layer is dark grayish-brown loam about 9 inches thick. Below is about 27 inches of brown firm clay over about 9 inches of dark grayish-brown, firm clay. Next is about 10 inches of reddish-brown, firm clay over yellowish-red, firm clay that extends to a depth of about 69 inches.

Included with this soil in mapping are small areas, mainly less than 5 acres in size, of Motley, Frankirk, Winters, and Tipton soils. These soils are along natural drainageways or on slightly higher parts of the landscape than this Rotan soil.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

Most of the acreage of this Rotan soil is cultivated. Wheat is the major crop. Good management practices include crop rotation, leaving crop residue on or near the surface, and limited but timely tillage. Contour cultivation, along with the use of terraces, is necessary to help control water erosion. Capability unit IIe-2, dryland; Clay Loam range site.

Tillman Series

The Tillman series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in ancient alluvium derived from red-bed clay and shale.

In a representative profile the surface layer is reddish-brown clay loam about 7 inches thick. Below this layer is about 17 inches of reddish-brown clay that is firm in the upper 6 inches and very firm below. Next is red clay, about 51 inches thick, that is very firm in the upper 28 inches and firm below. The underlying material is 15 inches or more of dark-red, very firm clay (fig. 22).

These soils are well drained and slowly permeable. Runoff is slow to medium, and available water capacity is high (fig. 23).

Representative profile of Tillman clay loam, 1 to 3 percent slopes, 1.8 miles west via Farm Road 1739 from its intersection with Farm Road 2384, then 0.2 mile north on private road and 30 feet west, in an area of range:

A1—0 to 7 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak, medium, granular and subangular blocky structure; hard, friable; neutral; clear, smooth boundary.

B21t—7 to 13 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium, blocky structure; very hard, firm; thin, continuous clay films; mildly alkaline; clear, smooth boundary.

B22t—13 to 24 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate, medium and coarse, blocky structure; very hard, very firm; distinct continuous clay films; calcareous, moderately alkaline; gradual, smooth boundary.

B23t—24 to 52 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium and coarse, blocky structure; very hard, very firm; distinct continuous clay films; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

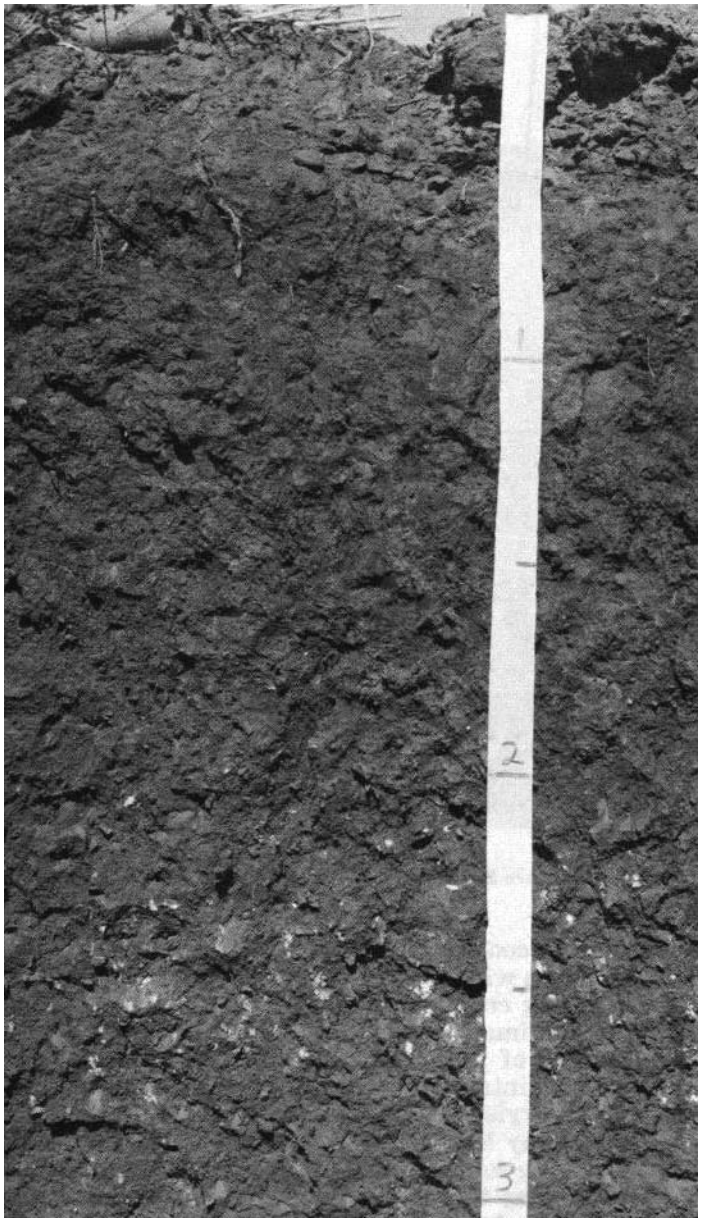


Figure 22.—Profile of Tillman clay loam, 1 to 3 percent slopes. Carbonates are visible at a depth of about 2 feet.

B24tca—52 to 75 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium, blocky structure; very hard, firm; thin patchy clay films; 5 percent, by volume, calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—75 to 90 inches, dark-red (2.5YR 3/6) clay, massive; very hard, very firm; few scattered calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 60 to more than 90 inches in thickness. Depth to carbonates ranges from 6 to 28 inches.

The A1 horizon is clay loam or silty clay loam that is reddish brown, dark reddish brown, brown, or dark brown. It ranges from 5 to 10 inches in thickness.

Figure 23.—Shrinking and swelling of this Tillman clay loam have severely cracked and damaged concrete street.

The Bt horizon is clay loam to clay that is reddish brown, dark reddish brown, red, dark red, or yellowish red. It is mildly or moderately alkaline.

The Btca horizon is at a depth of 36 to 60 inches.

The C horizon is clay or clayey shale that is red, dark red, olive, or olive yellow and is mottled in places.

Tillman clay loam, 0 to 1 percent slopes (TcA).—This nearly level soil is in areas that have a plane to weakly convex surface. Areas range from 10 to several hundred acres in size.

The surface layer is brown clay loam about 7 inches thick. Below this layer is about 8 inches of brown, firm clay over about 38 inches of reddish-brown, very firm clay. Next is about 17 inches of red, very firm clay. The underlying material is red, very firm clay.

Included with this soil in mapping are areas of Kamay, Vernon, and Deandale soils. Deandale soils are in depressions and along drainageways. Vernon soils are on slightly convex ridges or knobs.

The hazards of soil blowing and water erosion are slight on this soil.

A little less than 50 percent of the acreage of this Tillman soil is cultivated. Wheat is the major crop. The soil is too droughty for summer tillage and is better suited to cool-season crops. This soil is not suitable for irrigation with the quality of irrigation water available. Leaving crop residue on or near the surface and using a minimum amount of tillage help to control evaporation of moisture, increase moisture penetration, and maintain organic-matter content. Capability unit IIs-2, dryland; Clay Loam range site.

Tillman clay loam, 1 to 3 percent slopes (TcB).—This gently sloping soil is in areas that have a weakly convex surface. It has the profile described as representative of the series. Areas are irregular in shape and range from 8 to several hundred acres in size. Slopes are dominantly about 2 percent.

Included with this soil in mapping are areas of Vernon and Deandale soils, each of which makes up about 5 percent of the unit. Also included are areas of Kamay soils, which make up 10 percent of the unit. Vernon soils are more sloping than this Tillman soil, and their areas are more convex. Deandale soils are along old drainageways and are in lower positions on the landscape than this Tillman soil.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About 30 percent of the acreage of this Tillman soil is cultivated. Wheat is the major crop. This soil is too droughty for summer tillage and is better suited to cool-season crops. It is not suitable for irrigation with the quality of irrigation water available. Leaving crop residue on or near the surface helps to control water erosion and cuts down on evaporation of moisture. Contour cultivation, along with the use of terraces, helps to conserve moisture and to control erosion. Capability unit IIIe-2, dryland; Clay Loam range site.

Tillman and Deandale soils, saline, 0 to 3 percent slopes (TfB).—These nearly level to gently sloping soils are in areas that have a plane to weakly convex surface. Areas range from 5 to more than 100 acres in size and are irregular in shape.

The average composition of this unit is Tillman soils, 50 percent, and Deandale soils, 50 percent. The composition of any one area is variable. Tillman soils are dominant in most areas, but in some areas Deandale soils are dominant.

A Tillman soil in this unit has a surface layer of brown silty clay loam about 4 inches thick. Below this layer is dark reddish-brown and brown, very firm clay about 23 inches thick over about 21 inches of reddish-brown, very firm clay. Next, to a depth of 75 inches or more, is yellowish-red, very firm clay.

A Deandale soil in this unit has a surface layer of brown silt loam about 8 inches thick. Below this layer is about 42 inches of dark grayish-brown and brown, very firm clay over about 27 inches of dark-brown, very firm clay. Next, to a depth of 96 inches or more, is red clay.

Included with these soils in mapping, and making up about 10 percent of the unit, are soils that are not saline.

Most of the acreage of this unit is used as range or consists of formerly cultivated areas. Vegetation is sparse and consists mostly of salt-tolerant grasses and trees or shrubs. From 10 to 40 percent of the acreage is barren. These areas seem to have been made barren by irrigation seepage from irrigation ditches, by the presence of low-quality water, or by the presence of saltwater from oil fields. The salinity of the surface layer is mostly moderate to very high. The areas need to be established to salt-tolerant grasses such as bermudagrass. The surface should be covered with vegetation or mulches to keep evaporation from bringing additional salts to the surface. The water bringing in salts needs to be stopped at the source. Capability unit VIs-1, dryland; Clay Loam range site.

Tipton Series

The Tipton series consists of deep, nearly level, loamy soils on uplands. The soils formed in calcareous, loamy alluvium or eolian deposits.

In a representative profile the surface layer is dark-brown loam about 16 inches thick. Below this layer is 64 inches of reddish-brown, friable clay loam. The underlying material is 20 inches or more of yellowish-red loam.

These soils are well drained and moderately permeable. Runoff is slow, and available water capacity is high.

Representative profile of Tipton loam, 0 to 1 percent slopes, 1 mile west via Farm Road 370 from its intersection with Texas Highway 25, then 0.8 mile north on county road, then 100 feet east, in a cultivated field:

Ap—0 to 7 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

A1—7 to 16 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate, medium, granular structure; slightly hard, very friable; neutral; clear, smooth boundary.

B21t—16 to 36 inches, reddish-brown (5YR 4/3) clay loam; dark reddish brown (5YR 3/3) moist; weak to moderate, fine, subangular blocky structure; hard, friable; common fine pores; many worm casts; few thin clay films; neutral; clear, smooth boundary.

B22t—36 to 56 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak to moderate, fine, subangular blocky structure; hard, friable; common fine pores; few thin clay films; mildly alkaline; gradual, wavy boundary.

B3ca—56 to 80 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak, medium, subangular blocky structure; hard, friable; common films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C—80 to 100 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; slightly hard, very friable; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to calcareous material ranges from 36 to 65 inches.

The A horizon is brown, dark brown, grayish brown, or dark grayish brown and is 12 to 17 inches thick. It is neutral or mildly alkaline.

The Bt horizon is clay loam to loam that is reddish brown, dark brown, or brown. It is neutral to moderately alkaline.

The B3ca horizon is reddish brown, brown, or reddish yellow.

The C horizon is loam or clay loam that is yellowish red, reddish yellow, reddish brown, light reddish brown, red, or light red.

Tipton loam, 0 to 1 percent slopes (ToA).—This nearly level soil is in areas that have a plane surface. It has the profile described as representative of the series. Areas are irregular in shape and range from 5 to about 200 acres in size.

Included with this soil in mapping are areas of Rotan, Enterprise, and Motley soils. Also included and making up about 15 percent of the unit are areas of soils that have slopes of 1 to 1.5 percent.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Tipton soil is cultivated. Wheat is the major crop. Some areas are planted to cotton and grain sorghum. Conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. The cropping system should include sorghum, small grain, and other crops that leave a large amount of residue on or near the surface. Terraces help to conserve water. Capability unit IIc-2, dryland; Mixedland range site.

Tipton-Urban land complex (Tu).—This nearly level mapping unit is in areas along Holliday Creek, in the Wichita Falls area. Areas range from 25 to 212 acres in size. They are elongated and are parallel to the stream channel. Slopes are dominantly about 0.6 percent.

About 40 percent of this unit is Tipton soils, 30 percent is Urban land, and 30 percent is other soils. Soil areas are too small and too intermingled to be separated at the scale mapped.

A Tipton soil in this complex has a surface layer that is dark grayish-brown loam in the upper 6 inches and dark grayish-brown clay loam in the lower 11 inches. Below this layer is about 6 inches of reddish-brown, firm clay loam over about 28 inches of reddish-brown, firm clay loam. The underlying material, to a depth of 84 inches or more, is light reddish-brown clay loam that contains strata of sandy clay loam and fine sandy loam.

Urban land consists of works and structures, mostly houses, streets, roads, sidewalks, parking lots, and commercial buildings. The terrain is flat, and many of the areas have not been altered greatly by construction.

Included with this complex in mapping are areas of Clairemont soils. Also included and making up about 20 percent of the mapped areas are soils that are similar to Tipton soils except that dark colors extend to a depth of less than 20 inches.

Among the limitations to use of this complex for urban development are shrink-swell, which causes cracking and shifting of structures, and low strength, which restricts material suitable for building roads and streets. Not assigned to a capability unit or to a range site.

Tivoli Series

The Tivoli series consists of deep, gently undulating to rolling, sandy soils on uplands. The soils formed in sandy eolian sediment.

In a representative profile the surface layer is brown fine sand about 6 inches thick. The underlying material, to a depth of 60 inches or more, is reddish-yellow fine sand.

These soils are excessively drained and rapidly permeable. Runoff is very slow, and available water capacity is low.

Representative profile of Tivoli fine sand, 7 miles north on Texas Highway 25 from Haynesville, then 0.2 mile north and 0.3 mile west on county road from the end of Texas Highway 25, then 50 feet north, in an area of range:

A1—0 to 6 inches, brown (7.5YR 5/4) fine sand, brown (7.5YR 4/4) moist; single grained; loose, calcareous; moderately alkaline; clear, smooth boundary.

C—6 to 60 inches, reddish-yellow (5YR 7/6) fine sand, yellowish red (5YR 5/6) moist; single grained; loose; calcareous; moderately alkaline.

The A horizon is brown, light brown, or light reddish brown and is 4 to 10 inches thick. It is neutral to moderately alkaline.

The C horizon is reddish yellow, light brown, or light reddish brown and is 3 to many feet thick. It is neutral to moderately alkaline.

This soil is calcareous at a depth of less than 40 inches, which is not within the defined range for the series. This difference does not affect the use, management, or behavior of these soils.

Tivoli fine sand (Tv).—This gently undulating to rolling soil is on uplands and in narrow duny areas on flood plains. Most areas are much longer than they are wide and range from about 5 to 80 acres in size. Slopes range from 1 to 12 percent but are dominantly 3 to 8 percent.

Included with this soil in mapping are small areas, less than 5 acres, of Devol soils, which are between dunes that are lower than Tivoli soils. Also included are narrow bands of Lincoln soils between dunes.

The hazard of soil blowing is severe on this soil.

All of the acreage of this Tivoli soil is used as range. A good cover of vegetation is needed on this soil to help control soil blowing. Consideration needs to be given to the maintenance of a suitable habitat to furnish adequate food and cover for wildlife. Capability unit VIIe-1, dryland; Dune range site.

Urban Land

Urban land (Ua) is in the central part of Wichita Falls and extends in a narrow area eastward along U.S. Highway 287 Business and north into the industrial area along Texas Highway 240. An isolated area is in an oil industrial site in the east-central part of the Wichita Falls area. A large area is in the runway area of Sheppard Air Force Base.

Included with this land type in mapping are small areas where works and structures cover 35 to 75 percent of the surface. Small undisturbed areas of Kamay, Winters, Clairemont, and Mangum soils are also included.

Most of the soils that are not covered by urban works and structures were so altered during construction that they are not mapped separately. Deep cuts and fills made during construction severely alter the characteristics of the original soils.

Most of the sales, service, professional, and governmental function of the city are concentrated in this area. From 75 to 95 percent of Urban land is covered with works and structures, such as office buildings, service buildings, hotels, industrial yards, streets, parking lots, parking buildings, and railroads. On Sheppard Air Force Base, the area is covered by concrete and asphalt runways, taxiways and parking areas, operational buildings, dormitories, and streets. Not assigned to a capability unit or to a range site.

Vernon Series

The Vernon series consists of moderately deep, gently sloping to sloping, loamy soils on uplands. The soils formed in red-bed clay and shale.

In a representative profile the surface layer is reddish-brown clay loam about 7 inches thick. Below this layer is 27 inches of reddish-brown, very firm clay. The underlying material is 26 inches or more of dark-red clayey shale.

These soils are well drained and very slowly permeable. Runoff is medium to rapid, and available water capacity is medium.

Representative profile of Vernon clay loam, 3 to 5 percent slopes, 1 mile south on Farm Road 2384 from its intersection with Farm Road 1739, then 100 feet east, in an area of range:

A1—0 to 7 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, firm; calcareous; moderately alkaline; clear, smooth boundary.

B2—7 to 18 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, very firm; very sticky, plastic; few calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

B3—18 to 34 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak, medium, blocky structure; very hard, very firm; very sticky, plastic; particles of unweathered red-bed clay increasing with depth; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C—34 to 60 inches, dark-red (10R 3/6) clayey shale; massive; few pockets of calcium carbonate concretions decrease with depth; calcareous; moderately alkaline.

The A1 horizon is clay loam or clay that is reddish brown or brown. It ranges from 5 to 10 inches in thickness.

The B2 horizon is clay or silty clay that is reddish brown or red. It ranges from 10 to 20 inches in thickness.

The B3 horizon is reddish brown, red, or yellowish red and is 6 to 18 inches thick. It contains calcium carbonate that ranges from a few films and threads to soft masses and concretions, which make up about 10 percent of the horizon, by volume.

The C horizon is red, dark red, yellowish red, or reddish brown and is 20 to 36 inches thick. Olive, blue-green, or gray mottles and strata are common in this horizon.

Vernon clay loam, 1 to 3 percent slopes (VcB).—This gently sloping soil is on convex ridges. Areas range from 5 to about 200 acres in size. Most areas are less than 50 acres in size. Slopes are dominantly about 2.5 percent.

The surface layer is reddish-brown clay loam about 9 inches thick. Below this layer is about 18 inches of reddish-brown, very firm clay over about 9 inches of red, very firm clay. The underlying material, to a depth of 60 inches or more, is dark-red clayey shale.

Included with this soil in mapping are small areas of Tillman soils in areas that have a smooth surface. Also included are areas of Oben, Cobb, Bluegrove, and Owens soils, which make up about 5 percent of the unit.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About half the acreage of this Vernon soil is cultivated. Wheat is the major crop. If this soil is cultivated, it needs a cropping system that includes small grain, grain sorghum, or other crops that produce a large amount of residue. Leaving crop residue on or near the surface increases water intake and reduces erosion. Contour cultivation, used along with terraces, is needed to help control water erosion and to conserve moisture. Capability unit IVe-2, dryland; Shallow Clay range site.

Vernon clay loam, 3 to 5 **percent slopes** (VcC).—This gently sloping soil is on convex ridges and knobs. It has the profile described as representative of the series. Areas range from 5 to about 300 acres, but most are less than 50 acres in size. Slopes are dominantly about 4 percent.

Included with this soil in mapping, and making up about 10 percent of the unit, are areas of Oben, Cobb, and Bluegrove soils. Also included are areas of Owens soils, which make up about 10 percent of the unit.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

Most of the acreage of this Vernon soil is in native range. If this soil is cultivated, it needs a cropping system that includes wheat, grain sorghum, or other crops that produce a large amount of residue. Leaving crop residue on or near the surface increases water intake and reduces erosion. Terracing and contour farming are needed to help control water erosion and to conserve moisture. Range areas need good management and proper use of the perennial grass cover. Brush control is needed in some areas. Also, in places trails and roads need to be relocated or to have small dams or diversions constructed across them to break up concentrations of water. Productivity of forage is generally limited. Capability unit IVe-2, dryland; Shallow Clay range site.

Vernon and Owens soils, 3 to 8 **percent slopes (VoD).—**These gently sloping to sloping soils are in elongated areas and along the break or transition from upland areas to bottom lands or drainageways. Areas range from about 10 to several hundred acres in size; most are larger than 30 acres. The topography is a series of convex, rolling ridges and knobs. Soil patterns are irregular.

About 54 percent of this mapping unit is Vernon soils, 23 percent is Owens soils, and 23 percent is other soils. The range in percentage composition is Vernon soils, 15 to 75 percent; Owens soils, 10 to 45 percent; and other soils, 5 to 45 percent.

The Vernon soil has a surface layer of reddish-brown clay about 5 inches thick. Below this layer is about 27 inches of red, very firm clay. The underlying material, to a depth of 45 inches or more, is red clay that has blue-green mottles. Vernon soils are generally on the better vegetated and less sloping areas.

An Owens soil in this unit has a surface layer of reddish-brown clay about 4 inches thick. Below this layer is 14 inches of weak-red, very firm clay. The underlying material is weak-red clayey shale. Owens soils are generally sparsely vegetated and are steeper than the other soils in this mapping unit.

Included with these soils in mapping are areas of Mangum, Clairemont, Tillman, and Oben soils. Raw outcrops of clayey shale and sandstone are also included.

The hazard of water erosion is severe on these soils.

All of the acreage of this mapping unit is used as range. Good management practices and proper use of the perennial grass cover are needed. Brush control is needed in some areas. Also, in places trails and roads need to be relocated or to have small dams or diversions constructed across them to break up concentrations of water. Productivity of forage is limited. Capability unit VIe-1, dryland; Shallow Clay range site.

Waurika Series

The Waurika series consists of deep, nearly level, loamy soils on uplands. The soils formed in old alluvium or residuum weathered from red-bed clay and shale.

In a representative profile the upper part of the surface layer is dark grayish-brown silt loam about 15 inches thick. The subsurface layer is pale-brown silt loam about 3 inches thick. Below this layer is 52 inches of dark-brown and brown, very firm clay over 10 inches or more of yellowish-red, very firm clay.

These soils are somewhat poorly drained and very slowly permeable. Runoff is slow, and available water capacity is high.

Representative profile of Waurika silt loam, 0' to 1 percent slopes, 1.2 miles south via Hatton Road from its intersection with U.S. Highways 287 and 82 east of Wichita Falls, then 0.4 mile east on Hammon Road and 200 feet south, in an area of range :

A1—0 to 15 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; many roots; neutral; clear, smooth boundary.

A2—15 to 18 inches, pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak, fine, granular structure; slightly hard, friable; common roots; neutral; abrupt, wavy boundary.

B21t—18 to 48 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium and coarse, blocky structure; very hard, very firm; few roots; few iron and manganese concretions as large as 4 millimeters in diameter; common distinct, continuous clay films; mildly alkaline; gradual, smooth boundary.

B22t—48 to 70 inches, brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate, medium, blocky structure; very hard, very firm; few, thin, patchy clay films; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—70 to 80 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; weak, medium, subangular blocky structure; hard, very firm; few iron and manganese concretions; thin patchy clay films; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

The A1 horizon is grayish brown, dark grayish brown, brown, or dark brown and ranges from 10 to 16 inches in thickness.

The A2 horizon is grayish brown, pale brown, light brownish gray, brown, or light brown and ranges from 2 to 5 inches in thickness. It is medium acid to neutral.

The B2t horizon is brown, dark brown, pale brown, grayish brown, dark grayish brown, light brown, reddish brown, or yellowish red and ranges from 25 to more than 60 inches in thickness. It is neutral to moderately alkaline. This horizon is calcareous at a depth of 30 to 48 inches. It is mostly clay but ranges from sandy clay loam to clay.

A C horizon, which occurs in some profiles, is clay loam to silty clay loam that is brown, dark gray, gray, dark grayish brown, or light gray. It contains mottles and strata or red, yellow, brown, or gray.

Waurika silt loam, 0 to 1 percent slopes (WaA).—This nearly level soil is on upland areas that have a weakly concave surface. Areas range from 15 to more than 200 acres in size. Slopes are dominantly 0.4 percent.

Included with this soil in mapping are areas of Kirkland and Renfrow soils.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Waurika soil is in native range. Leaving crop residue on or near the surface helps to control evaporation of moisture, increase moisture penetration, and maintain the supply of organic matter. Capability unit IIs-1, dryland; Claypan Prairie range site.

Winters Series

The Winters series consists of deep, nearly level to gently sloping, loamy soils on uplands. The soils formed in loamy, old stream alluvium.

In a representative profile the surface layer is reddish-brown loam about 7 inches thick. Below is reddish-brown and red, firm clay about 63 inches thick over 20 inches or more of red, friable clay loam.

These soils are well drained and moderately slowly permeable. Runoff is medium, and available water capacity is high. The wet phase is somewhat poorly drained and has medium available water capacity.

Representative profile of Winters loam, 1 to 3 percent slopes, 0.9 mile west via Farm Roads 367 and 368 from the junction of Farm Roads 367 and 368 about 1 mile south of Iowa Park, and 200 feet south, in a cultivated field:

Ap—0 to 7 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure, slightly hard, very friable; neutral; abrupt, smooth boundary.

B21t—7 to 26 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate, fine and medium, blocky structure; very hard, firm; common, distinct, continuous clay films on surfaces of peds; neutral; gradual, smooth boundary.

B22t—26 to 41 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, fine and medium, blocky structure; very hard, firm; common, continuous, distinct clay films on surfaces of peds; few calcium carbonate concretions in lower part; mildly alkaline; gradual, smooth boundary.

B23t—41 to 53 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, fine, subangular blocky and blocky structure; very hard, firm; few, thin, patchy clay films; mildly alkaline; gradual, smooth boundary.

B24tca—53 to 70 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, fine, subangular blocky structure; hard, firm; few, thin, patchy clay films; 5 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3—70 to 90 inches, red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; weak, fine, subangular blocky structure; hard, friable; calcareous; moderately alkaline.

The solum ranges from 60 to more than 90 inches in thickness. Depth to carbonates is 30 to 50 inches. Carbonates are mostly in the form of concretions and range from few to common.

The A horizon is reddish brown or brown and is 4 to 12 inches thick. It is neutral or mildly alkaline.

The B2t horizon is clay loam to clay that is reddish brown, dark reddish brown, red, or yellowish red. It is neutral to moderately alkaline.

The B3 horizon is clay loam, sandy clay loam, sandy clay, or clay that is red, reddish brown, yellowish red, or reddish yellow.

About 20 to 35 percent of Winters soils are underlain by gravel, conglomerate, sandstone, or clayey shale at a depth of 6 to 10 feet.

Winters loam, 0 to 1 percent slopes (WnA).—This nearly level soil is on terraces and uplands. Areas have a plane to slightly convex surface, are irregular in shape, and range from about 10 to several hundred acres in size.

The surface layer is brown loam about 7 inches thick. Below this layer is about 47 inches of reddish-brown, firm clay. Next, to a depth of 100 inches, is red, firm clay loam (fig. 24).

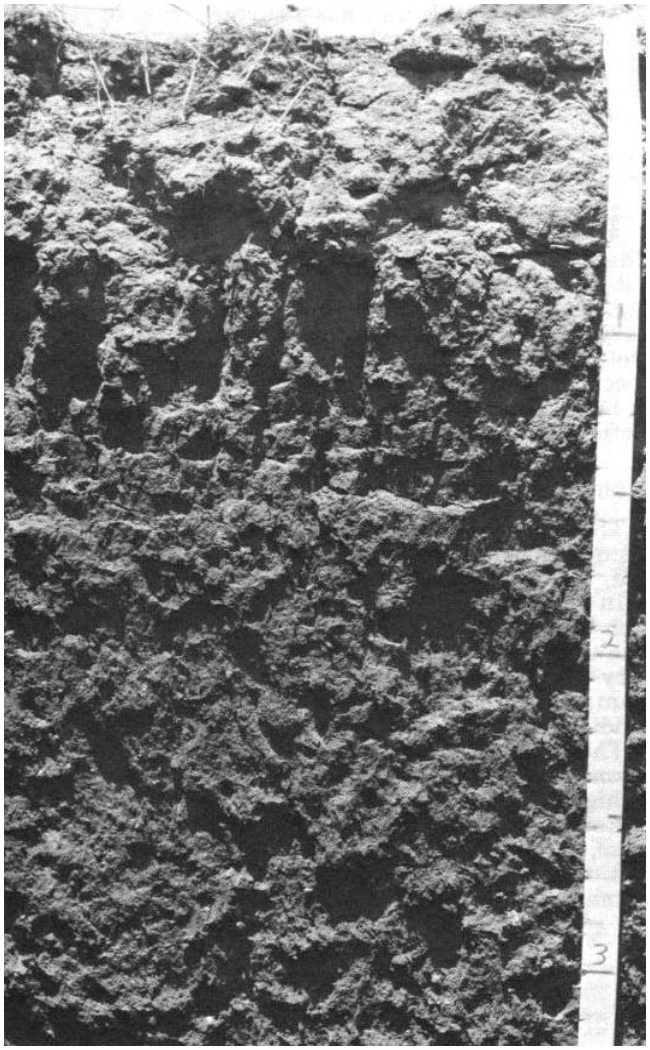


Figure 24.—Profile of Winters loam, 0 to 1 percent slopes. Note abrupt change at a depth of about 7 inches.

Included with this soil in mapping are small areas, less than 5 acres, of Deandale silt loam, loamy substratum, which occupies slightly lower positions on the landscape than Winters soils. Small spots of Winters soils, wet, which have a water table at a depth of less than 6 feet, are also included. Another inclusion is small areas of a soil similar to Winters loam, except that depth to the loamy to gravelly underlying material is 48 to 60 inches.

The hazards of soil blowing and water erosion are slight on this soil.

Most of the acreage of this Winters soil is cultivated. About 50 percent is irrigated. Wheat is the major dryland crop, and wheat, alfalfa, and bermudagrass are the major irrigated crops. The soil has a medium to high hazard of salinity when irrigated, because of the quality of irrigation water available. Good management practices include crop rotation, leaving crop residue on or near the surface, and timely but limited tillage. When this soil is irrigated, crops of medium to high salt tolerance should be used. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that permit effective leaching and most efficient use of rainfall are needed. Capability unit IIc-1, dryland; IIIs-1, irrigated; Clay Loam range site.

Winters loam, 1 to 3 percent slopes (WnB).—This gently sloping soil is in areas that have a convex surface. It has the profile described as representative of the series. Areas are irregular in shape and range from 10 to several hundred acres in size.

Included with this soil in mapping, and making up about 15 percent of the unit, are areas of Deandale silt loam, loamy substratum; Frankirk soils; and Bluegrove soils.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

Most of the acreage of this Winters soil is cultivated. Wheat is the major dryland crop. Wheat, alfalfa, and bermudagrass are the major irrigated crops. This soil has a medium to high hazard of salinity when irrigated, because of the quality of irrigation water available. Good management practices include crop rotation, leaving residue on or near the surface, and limited but timely tillage. Contour cultivation, used along with terraces, is necessary to help control water erosion. If this soil is irrigated, crops of medium to high salt tolerance should be used. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that permit effective leaching and efficient use of rainfall are needed. Capability unit IIe-2, dryland; IIIs-2, irrigated; Clay Loam range site.

Winters loam, 3 to 5 percent slopes (WnC).—This gently sloping soil is in areas that have a convex surface. Areas are irregular in shape and range from 5 to about 100 acres in size.

The surface layer is reddish-brown loam about 9 inches thick. Below this layer is about 19 inches of reddish-brown, firm clay. Next, to a depth of 82 inches or more, is red, firm clay.

Included with this soil in mapping, and making up about 10 percent of the unit, are Bluegrove soils. Also included, and making up about 5 percent of the unit, are soils in which carbonates are at a depth of less than 28 inches.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate on this soil.

About half the acreage of this Winters soil is cultivated. Wheat is the major crop. Good management practices include leaving crop residue on or near the surface, timely but limited tillage, and contour cultivation, along with the use of terraces. This soil responds to applications of fertilizer. Capability unit IIIe-3, dryland; Clay Loam range site.

Winters loam, wet (Ws).—This soil is nearly level to gently sloping. Areas are about 10 to 50 acres in size and are long and narrow. Slopes are dominantly 0 to 2 percent.

The surface layer is reddish-brown loam about 7 inches thick. Below this layer is about 12 inches of reddish-brown, firm clay loam over about 27 inches of red, very firm clay. Next is about 28 inches of red, firm sandy clay loam.

Included with this soil in mapping are areas of Deandale and Frankirk soils. Also included are areas of Grandfield soils, which make up about 15 percent of the unit.

This soil is mostly used for pasture and as range. Bermudagrass is suitable for pasture. This soil has either a water table at a depth of 3 to 6 feet or restricted surface drainage that keeps it wet for significant periods. It has a moderate to high hazard of salinity because of restricted drainage and leaching. The main concerns of management are to maintain or improve soil condition, adapt cropping systems to the soil limitations, and manage water. Leaving residue on or near the surface helps to reduce evaporation, which brings harmful salts toward the surface. Mulches, such as cotton burs, also help reduce evaporation. Capability unit VIw-1, dryland; IIIw-1, irrigated, after drainage; Clay Loam range site.

Winters-Urban land complex, 0 to 3 percent slopes (WuB).—This nearly level to gently sloping mapping unit is in areas that are irregular in shape. The areas range from 23 to 705 acres in size. Slope is dominantly less than 1 percent.

About 40 percent of this unit is Winters soils, 50 percent is Urban land, and 10 percent is other soils. Soil areas are too small and too intermingled to be separated at the scale mapped.

A Winters soil in this complex has a surface of layer of brown loam about 9 inches thick. Below this layer is 16 inches of reddish-brown, very firm clay over about 39 inches of red, firm clay. Next is 36 inches of red, firm sandy clay loam.

Urban land consists of works and structures, mostly homes, schools, businesses, streets, roads, and sidewalks. On the nearly level parts of this unit only a few cuts and fills have been made. Where slope is more than 1.5 percent, about half of the area has been cut or filled.

Included with this unit in mapping are areas of Deandale, Frankirk, and Bluegrove soils.

Among the limitations to use of this complex for urban development are shrink-swell, which causes cracking and shifting of structures; permeability, which contributes to failure of septic tank filter fields; and corrosivity, which results in failure of steel pipelines. Not assigned to a capability unit or to a range site.

Yahola Series

The Yahola series consists of deep, nearly level, loamy soils on bottom lands. The soils formed in slightly altered, loamy, calcareous alluvium.

In a representative profile the surface layer is reddish-brown fine sandy loam about 10 inches thick. The underlying material, to a depth of 60 inches or more, is pink fine sandy loam that contains strata of very fine sandy loam and fine sand.

These soils are well drained and moderately rapidly permeable. Runoff is slow, and available water capacity is medium.

Representative profile of Yahola fine sandy loam in an area of Yahola and Yomont soils, frequently flooded, 1.85 miles north via Texas Highway 25 from Kadane Corner, then 1 mile east on county road and 0.3 mile southeast, in an area of range, about 50 feet northeast of the river channel:

A1—0 to 10 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; slightly hard, very friable; thin strata of silt loam; calcareous; moderately alkaline; clear, smooth boundary.

C—10 to 60 inches, pink (5YR 8/4) fine sandy loam, pink (5YR 7/4) moist; massive; soft, very friable; thin strata of very fine sandy loam and fine sand 2 millimeters to 2 inches thick; bedding planes are evident; calcareous; moderately alkaline.

The A1 horizon is loam or fine sandy loam that is dark reddish brown, reddish brown, or light reddish brown. It ranges from 6 to 15 inches in thickness.

The C horizon is fine sandy loam that contains thin strata of silty clay loam, silt loam, very fine sandy loam, and loamy sand. It is pink to light reddish brown, reddish brown, yellowish red, reddish yellow, light red, or red.

Yahola and Yomont soils, frequently flooded (Ya).—This mapping unit is in areas that are parallel to stream channels. The areas are 100 to 1,000 feet wide, and the average width is about 400 feet. The stream channel meanders within these areas, and water flows all year. The soils within these areas are on benches at various elevations. Soil patterns are irregular.

About 60 percent of this mapping unit is Yahola soils, 28 percent is Yomont soils, and 12 percent is other soils. The range in percentage composition is Yahola soils, 40 to 90 percent; Yomont soils, 10 to 40 percent; and other soils, 0 to 20 percent.

A Yomont in this unit has a surface layer of reddish-brown very fine sandy loam about 10 inches thick. The underlying material, to a depth of 60 inches or more, is light reddish-brown very fine sandy loam that contains strata of silt loam.

Included with this unit in mapping are areas of Clairemont and Lincoln soils.

The hazards of soil blowing and water erosion are slight on these soils.

All of the acreage of this unit is used as range. These soils are flooded at least once a year. They are not suited to cultivation, because of the hazard of flooding. This unit is suitable for use as range, wildlife habitat, and recreation areas. Proper grazing and control of brush are good management practices. Woody species that are suitable for habitat for wildlife need to be retained. Capability unit Vw-1, dryland; Loamy Bottomland range site.

Yomont Series

The Yomont series consists of deep, nearly level, loamy soils on bottom lands. The soils formed in stratified, calcareous, loamy alluvium.

In a representative profile the surface layer is reddish-brown very fine sandy loam about 10 inches thick. The underlying material is 10 inches of reddish-yellow very fine sandy loam over 6 inches of pink fine sandy loam; next, to a depth of 96 inches or more, is light reddish-brown very fine sandy loam (fig. 25).

These soils are well drained and moderately rapidly permeable. Runoff is slow, and available water capacity is high.

Representative profile of Yomont very fine sandy loam, 0.6 mile south via Farm Road 368 from its intersection with Farm Road 367, then 100 feet east, in a bermudagrass pasture:

Ap—0 to 10 inches, reddish-brown (2.5YR 5/4) very fine sandy loam, reddish brown (2.5YR 4/4) moist; weak, fine, granular structure; soft, very friable; common fine and very fine roots; calcareous; moderately alkaline; abrupt, smooth boundary.

C1—10 to 20 inches, reddish-yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 4/6) moist; massive; soft, very friable; thin strata of silt loam; bedding planes are evident; common fine roots; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

C2—20 to 26 inches, pink (5YR 7/4) fine sandy loam, reddish brown (5YR 5/4) moist; massive; soft, very friable; thin strata of silt loam 1/8 to ½ inch thick; bedding planes are evident; few very fine roots; calcareous; moderately alkaline; clear, smooth boundary.

C3—26 to 96 inches, light reddish-brown (2.5YR 6/4) very fine sandy loam, reddish brown (2.5YR 4/4) moist; thin strata of reddish-brown (2.5YR 4/4) silt loam and pink (5YR 7/4) fine sandy loam; bedding planes are distinct; massive; soft, very friable; few very fine roots; calcareous; moderately alkaline.

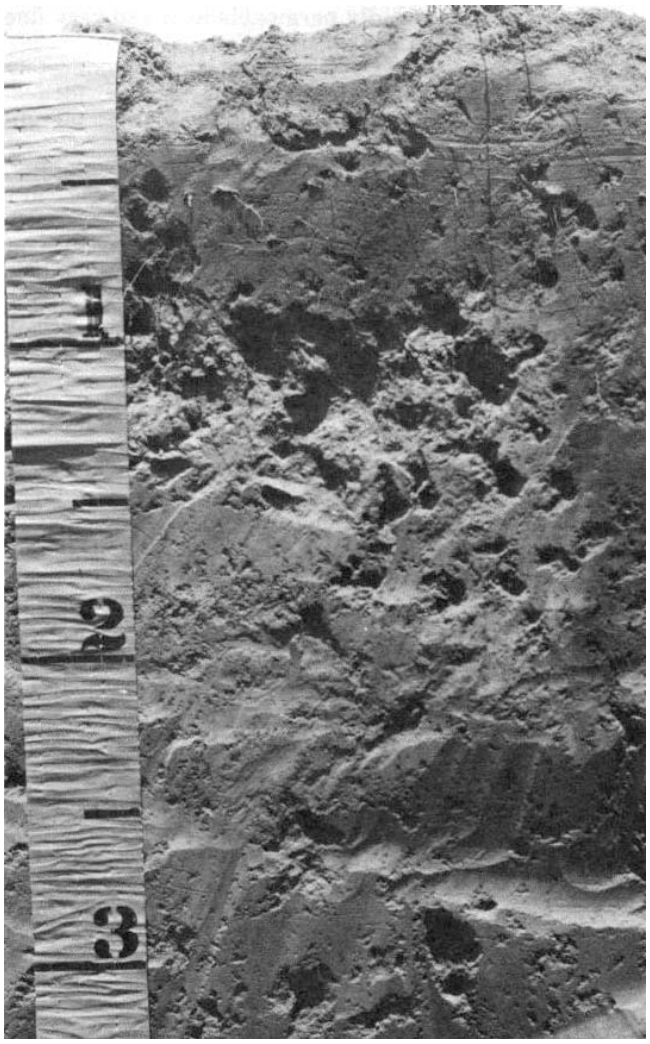


Figure 25.—Profile of Yomont very fine sandy loam shows the roots in the upper 10 inches.

The A horizon is reddish brown or yellowish red and is 7 to 12 inches thick.

The C horizon is mostly very fine sandy loam that contains strata of fine sandy loam, silt loam, loam, and loamy fine sand. It is reddish brown, light reddish brown, pink, reddish yellow, or yellowish red.

In some profiles buried horizons that are dark in color are below a depth of 40 inches. In some profiles layers of silty clay loam and clay are below a depth of 4 feet.

Yomont very fine sandy loam (Yo).—This nearly level soil is on bottom lands along rivers and large creeks. Areas are roughly parallel to stream channels and range mainly from 10 to 200 acres in size. Slopes range from about 0.5 to 1.5 percent.

Included with this soil in mapping are narrow bands, less than 5 acres in size, of Clairemont soils, which occupy slightly lower positions on the flood plains than this Yomont soil. A few narrow benches of Lincoln and Yahola soils are also included.

About 80 percent of the acreage of this Yomont soil is cultivated. Much of the acreage along the Wichita River is irrigated from Lake Diversion. Wheat is the major dryland crop. Alfalfa, wheat, and bermudagrass are the major irrigated crops. Some areas are occasionally flooded, but the water remains only for a few hours. Under good management, this soil is well suited to dryland or irrigated crops. This soil has a

medium hazard of salinity when irrigated, because of the quality of irrigation water available. If this soil is irrigated, crops of medium salt tolerance should be grown. This soil requires leaching to keep salts from accumulating near the surface. Surface irrigation systems that permit effective leaching and efficient use of rainfall are needed. Conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. Capability unit IIw-1, dryland; IIs-2, irrigated; Loamy Bottomland range site.

Use and Management of the Soils

This section explains the capability classification in which the soils are grouped according to their suitability for most kinds of farming and discusses the management of the soils by capability units. It gives a brief description of irrigation in the county and gives estimates of crop yields for both dryland and irrigated soils. Use and management of the soils for range, recreational developments, wildlife habitat, and engineering purposes are also discussed.

Crops

Conservation management and treatment of the soils modify the limitations involved in their use and affect the response of crops. Because of climate, the choice of crops is limited. Cotton, wheat, oats, barley, winterpeas, alfalfa, bermudagrass, and most grain and forage sorghum are among the crops suited to both the soils and the climate. The chief limitations to farming in Wichita County result from high winds, low annual rainfall, occasional periods of drought, the high intensity of some rains, and the high clay content and restricted permeability of some soils. The concerns of management are to conserve moisture, to protect the soils against both soil blowing and water erosion, to improve the physical condition of the soils, and to maintain productivity.

Capability grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops, the risk of damage when they are farmed, and the way the soils respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management.

Those familiar with the capability classification system can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. The subclass indicates major kinds of limitations within the classes. Within most classes there can be up to four subclasses. The subclasses are indicated by adding a small letter—*e*,

w, *s*, or *c*—to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil interferes with plant growth or cultivation (in some soils wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* indicates that the chief limitation is a climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, or wildlife habitat.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, require about the same management, and have generally similar productivity and other responses to management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIs-2.

The eight classes in the capability system and the subclasses and units represented in Wichita County are described in the list that follows. The names of the soils in any given capability unit are provided in the "Guide to Mapping Units."

Class I. Soils have few limitations that restrict their use (no subclasses). (None in Wichita County.)

Class II. Soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIc. Soils moderately limited because of dry climate.
- Unit IIc-1 (Dryland). Deep, nearly level, well-drained, moderately slowly permeable to slowly permeable loams to clay loams; on uplands.
- Unit IIc-2 (Dryland). Deep, nearly level, well-drained, moderately permeable to moderately rapidly permeable loams to very fine sandy loams; on uplands.

Subclass IIe. Soils subject to moderate erosion unless protected.
- Unit IIe-1 (Dryland). Deep, gently sloping, well-drained, moderately permeable to moderately rapidly permeable loams to very fine sandy loams; on uplands.
- Unit IIe-2 (Dryland). Deep to moderately deep, gently sloping, well-drained, moderately permeable fine sandy loams; on uplands.
- Unit IIe-3 (Dryland). Deep, gently sloping, well-drained, moderately permeable fine sandy loams; on uplands.

Subclass IIs. Soils moderately limited because of permeability or irrigation water of low quality.
- Unit IIs-1 (Dryland). Deep, nearly level, somewhat poorly drained to well-drained, very slowly permeable silt loams to loams; on uplands.
- Unit IIs-1 (Irrigated). Deep, nearly level to gently sloping, well-drained, moderately permeable silt loams to fine sandy loams; on flood plains.
- Unit IIs-2 (Dryland). Deep, nearly level, well-drained, slowly permeable clay loams; on uplands.
- Unit IIs-2 (Irrigated). Deep, nearly level, well-drained, moderately rapidly permeable very fine sandy loams; on flood plains.

Subclass IIw. Soils moderately limited because of excess water.
- Unit IIw-1 (Dryland). Deep, nearly level, well-drained, moderately permeable to moderately rapidly permeable silt loams to very fine sandy loams; on flood plains.
- Unit IIw-1 (Irrigated). Deep, nearly level, somewhat poorly drained, moderately permeable silt loams; on flood plains.
- Unit IIw-2 (Dryland). Deep, nearly level, well-drained, very slowly permeable silty clay loams; on flood plains.

Unit IIw-3 (Dryland) . Deep, nearly level, well-drained, moderately permeable silty clay loams; on flood plains.

Class III. Soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe-1 (Dryland) . Deep, nearly level to gently sloping, well-drained, very slowly permeable loamy fine sands; on uplands.

Unit IIIe-2 (Dryland) . Deep, gently sloping, well drained to moderately well drained, slowly permeable to very slowly permeable clay loams to loams; on uplands.

Unit IIIe-3 (Dryland). Deep to moderately deep, gently sloping, well-drained, moderately permeable to moderately slowly permeable loams; on uplands.

Unit IIIe-4 (Dryland). Moderately deep, gently sloping, well-drained, moderately permeable fine sandy loams; on uplands.

Unit IIIe-5 (Dryland). Deep, gently sloping, well-drained, moderately permeable to moderately rapidly permeable loams to very fine sandy loams; on uplands.

Unit IIIe–6 (Dryland). Deep, gently sloping, well-drained, moderately rapidly permeable fine sandy loams; on uplands.

Unit IIIe–7 (Dryland) . Deep, nearly level to gently sloping, somewhat excessively drained, rapidly permeable fine sandy loams; on flood plains.

Unit IIIe–8 (Dryland) . Deep, gently sloping, well-drained, moderately rapidly permeable fine sandy loams that have a moderate hazard of water erosion; on uplands.

Subclass IIIs. Soils severely limited because of moderately slow and very slow permeability and irrigation water of low quality.

Unit IIIs–1 (Irrigated). Deep, nearly level, well-drained, moderately slowly permeable to very slowly permeable loams to silty clay loams; on uplands and flood plains.

Unit IIIs–2 (Irrigated) . Deep, gently sloping, well-drained, moderately slowly permeable loams; on uplands.

Subclass IIIw. Soils severely limited for cultivation because of excess water.

Unit IIIw–1 (Dryland). Deep, nearly level, well-drained, very slowly permeable clays; on flood plains.

Unit IIIw–1 (Irrigated). Deep, nearly level to gently sloping, somewhat poorly drained, moderately slowly permeable loams; on uplands.

Class IV. Soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Unit IVe–1 (Dryland) . Deep, sloping, well-drained, moderately rapidly permeable very fine sandy loams; on uplands.

Unit IVe–2 (Dryland). Moderately deep, gently sloping, well-drained, very slowly permeable clay loams; on uplands.

Unit IVe–3 (Dryland). Shallow, gently sloping, well-drained, moderately permeable fine sandy loams; on uplands.

Subclass IVs. Soils severely limited because of very slow permeability and low quality of irrigation water.

Unit IVs–1 (Irrigated). Deep, nearly level, moderately well drained to well drained, very slowly permeable silt loams to clays; on uplands and flood plains.

Subclass IVw. Soils very severely limited because of excess water.
Unit IVw–1 (Irrigated). Deep, nearly level, somewhat poorly drained, very slowly permeable clays to silt loams; on uplands, terraces, and flood plains.

Class V. Soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.
Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.
Unit Vw–1 (Dryland) . Deep, nearly level, well-drained, moderately permeable silt loams; on flood plains.
Unit Vw–2 (Dryland) . Deep, nearly level, somewhat excessively drained, rapidly permeable loamy fine sands; on flood plains.

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
Subclass VIe. Soils severely limited, chiefly by risk of erosion, unless protective cover is maintained.
Unit VIe–1 (Dryland). Shallow to moderately deep, gently sloping to sloping, well-drained, very slowly permeable clay loams to clays; on uplands.
Unit VIe–2 (Dryland). Deep, strongly sloping to moderately steep, well-drained, moderately rapidly permeable very fine sandy loams; on uplands.
Subclass VIs. Soils severely limited because of excess salts.
Unit VIs–1 (Dryland). Deep, nearly level to gently sloping, moderately well drained to well drained, slowly permeable to very slowly permeable silt loams to silty clay loams; on uplands.
Subclass VIw. Soils severely limited because of excess water.
Unit VIw—1 (Dryland) . Deep, nearly level to gently sloping, somewhat poorly drained loams to clays; on flood plains and uplands.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to range, woodland, or wildlife habitat.
Subclass VIIe. Soils very severely limited, chiefly by risk of erosion, unless protective cover is maintained.
Unit VIIe–1 (Dryland) . Deep, gently undulating to rolling, excessively drained, rapidly permeable fine sands; on uplands.
Subclass VIIs. Soils very severely limited because of shallow depth, moisture capacity, rock outcrop, or other features.
Unit VIIs–1 (Dryland). Very shallow to deep, gently sloping to steep, well-drained, moderately permeable to very slowly permeable fine sandy loams to clays; on uplands and flood plains.

Class VIII. Soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.
Subclass VIIIs. Area is very severely limited because of high to very high salinity.
Unit VIIIs–1 (Dryland). Area is nearly level to strongly sloping. It is mostly barren because of accumulation of oil and saline liquid and solid waste from oil-drilling operations.

Irrigation

Irrigation water used in Wichita County comes mainly from water in Lake Kemp and Lake Diversion. In the northern part of the county, a few areas of soils are irrigated from small, shallow wells. Estimates concerning irrigation capabilities and crop yields, except for those on Lincoln soils, and statements concerning irrigation are based on the use of canal water from Lake Diversion.

Lakes Kemp and Diversion were constructed in 1922. Wichita County Water Improvement District Number 1 was organized on December 20, 1919, embracing an area of 15,543 acres, including the city of Wichita Falls. Wichita County Water Improvement District Number 2 was organized on December 11, 1920, embracing an area of approximately 55,000 acres. The Lake Kemp Dam was completed in 1923. The irrigated area is between Diversion Dam and the western boundary of Clay County and is almost entirely within Wichita County. The southside canal is 34.16 miles long; the northside canal is 29.71 miles long; and the entire lateral canal system is 148.27 miles in length, making a total system of 212.14 miles. In 1925, 19,875 acres was irrigated. The irrigated acreage had increased to 30,195 acres in 1931. In the 1966-67 conservation needs inventory, an estimated 18,323 acres was irrigated.

The water available for irrigation in the Wichita River Valley is of permissible to doubtful quality, depending on the texture, permeability, chemical nature, and physical condition of the soil. The quality of water varies from season to season. Runoff water between Lake Kemp and Lake Diversion is of better quality than the Lake Kemp water. This is an advantage when Lake Diversion is low and catches more of the higher quality water. For continued use of this low-quality water, careful irrigation practices should be followed, such as leaching, even distribution of water in required amounts. Good land preparation, and possibly soil amendments, in addition to intensive management practices. An important management practice is to keep the surface covered with vegetation or residue most of the time, especially during the hot summer months. A cover of vegetation helps to prevent excessive evaporation and the subsequent accumulation of salts in the upper part of the soil.

The quality of the water, together with the chemical and physical condition of the soil, often make it necessary to grow only crops of medium to high salt tolerance and to eliminate crops of low salt tolerance from the cropping system. Irrigation improperly used decreases both fertility and productivity and may create a high water table or other drainage problems. Productivity is often limited by the physical condition of the soil, as well as by its fertility. An excessive amount of sodium, both in its exchangeable form and as water-soluble salts, is responsible for a dispersed condition in many soils that causes the soil to run together when wet and to dry out to a very hard crust. This dispersed condition reduces the rate at which water enters and moves through the soil. The introduction of Coastal bermudagrass and other improved bermudagrass varieties, which have a high salt tolerance, has caused a rapid increase in the acreage of irrigated pasture and hayland in the county.

Predicted yields

Table 2 lists predicted yields of the principal crops grown in Wichita County. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the county, and on information taken from research data. The predicted yields are average yields per acre that can be expected by good commercial farmers at the level of management that tends to produce the highest economic returns.

The yields are given for both dryland and irrigated soils if the soils are farmed under both methods. If only one method is practical, yields for only this method of farming are given. Not included in this table are soils that are used only as range or for recreation.

Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included in the table because the acreage is small or reliable data on yields are not available.

The predicted yields given in table 2 can be expected if the following management practices are used:

Dryland—

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems, or both, are installed.
3. Crop residue is managed to maintain soil tilth.
4. Minimum but timely tillage is used.
5. Insect, disease, and weed control measures are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Adapted crop varieties are used at recommended seeding rates.
8. Haying or grazing is done at a height that is best for the grass used.

Irrigated (the following practices are used, in addition to the ones indicated for dryland)—

1. Leaching applications of irrigation water are periodically used.
2. Irrigation is timed to meet the needs of the soil and the crop.
3. Irrigation systems are properly designed and efficiently used.

Range

By JON A. DARROW, range conservationist, Soil Conservation Service

About 190,000 acres, or about 28 percent, of Wichita County is in range. The range is used primarily for beef production. Thirteen types of plant communities are in Wichita County. For the most part the plant communities are open grasslands that have concentrations of trees along creeks and rivers. Mid grasses are the chief vegetation except on the Deep, Sandy, Loamy, and Sandy Bottomland range sites. Tall grasses dominate these range sites.

Wichita County was once open grassland, but it has been heavily invaded by mesquite. Only in areas of planned brush control is the vegetation near climax condition.

Range sites and condition classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community; it reproduces itself and does not change as long as the environment remains unchanged. Throughout the prairie and the plains the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They are generally the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are generally shorter than decreasers and less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there. A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in *good* condition if the percentage is 51 to 75, in *fair* condition if the percentage is 26 to 50, and in *poor* condition if the percentage is less than 25.

Potential forage production depends on the range site. Current forage production depends on the range condition and on the moisture available to plants during their growing season.

A primary objective of good range management is to keep range in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. The concern is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some range that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of range sites

In the following pages, the range sites of Wichita County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition. The soils in each range site can be determined by referring to the “Guide to Mapping Units” at the back of this survey.

CLAY LOAM RANGE SITE

This site consists of nearly level to gently sloping, deep loams and clay loams. Permeability is moderately slow to very slow, and available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate. Surface crusting is a concern if the vegetation cover deteriorates.

The climax plant community consists of a mid-grass prairie. Side-oats grama makes up about 25 percent of the climax plant community, vine-mesquite 20 percent, Arizona cottontop 15 percent, buffalograss 10 percent, Texas wintergrass 5 percent, white tridens 5 percent, and forbs 5 percent. Among the climax forbs are curly-cup gumweed, heath aster, western ragweed, trailing ratany, wild onion, greenthread, dotted gayfeather, indian rushpea, spiderwort, and gaura.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,300 pounds to 2,500 pounds per acre, depending on the amount of rainfall. About 95 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, buffalo-grass becomes the dominant grass, and tobosagrass increases. Upon further deterioration of the site, such grasses as red grama, purple three-awn, and hairy tridens dominate, and mesquite, lotebush condalia, and pricklypear invade (fig. 26).

CLAYEY BOTTOMLAND RANGE SITE

This site consists of nearly level to steep, deep silty clays and clays. Permeability is very slow, and available water capacity is medium to high. The hazard of soil blowing is slight, and the hazard of water erosion is slight to severe.

Figure 26.—Brush has been controlled on this area of Tillman clay loam, 1 to 3 percent slopes, in the Clay Loam range site.

The climax plant community consists of mid grasses and short grasses. Scattered elm, hackberry, bumelia, and hawthorn trees are throughout the site. Buffalo-grass makes up about 25 percent of the climax plant community, alkali sacaton 20 percent, white tridens 10 percent, meadow dropseed 10 percent, white tridens 10 percent, western wheatgrass 5 percent, blue grama 5 percent, silver bluestem 5 percent, perennial sedges 5 percent, and perennial forbs 5 percent. Among the climax forbs are western ragweed, heath aster, green-thread, trailing ratany, indian rushpea, and wild onion.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 900 pounds to 2,000 pounds per acre, depending on the amount of rainfall. About 90 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, vine-mesquite decreases, and buffalograss and alkali sacaton increase. If the site becomes bare of vegetation, establishing a grass cover is difficult, because the soils are clayey, and they do not respond well to mechanical revegetation.

CLAYPAN PRAIRIE RANGE SITE

This site consists of nearly level to gently sloping, deep loams and silt loams. Permeability is very slow, and the available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate. Surface crusting is a concern if the vegetative cover deteriorates.

The climax plant community consists of a mid-grass and short-grass prairie. Vine-mesquite makes up about 25 percent of the climax plant community, side-oats grama 15 percent, buffalograss 10 percent, Arizona cottontop 10 percent, blue grama 5 percent, western wheatgrass 5 percent, Texas wintergrass 5 percent, tall dropseed 5 percent, Wright and purple three-awn 5 percent, silver bluestem 5 percent, white tridens 5 percent, and perennial forbs 5 percent. Among the climax forbs are heath aster, western ragweed, dotted gay-feather, greenthread, Englemanndaisy, wild onion, Indian rushpea, and catclaw sensitivebriar.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,500 pounds to 3,000 pounds per acre, depending on the amount of rainfall. About 95 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, side-oats grama, vine-mesquite, and Arizona cottontop decrease; buffalograss becomes the dominant grass; and gummy lovegrass, tumble lovegrass, Japanese brome, prickly-pear, lotebush condalia, and mesquite invade. This site difficult to reseed unless a complete seedbed is prepared, because buffalograss is competitive with new seedlings (fig. 27).

Figure 27.—Cattle grazing on an area of Kamay silt loam, 1 o 3 percent slopes, in the Claypan Prairie range site.

DRAW RANGE SITE

This site consists of nearly level silty clay loams that are on flood plains along the rivers, creeks, and small drainageways. Permeability is moderate to very slow, and available water capacity is high. The hazards of soil blowing and water erosion are slight.

The climax plant community consists of mid-grasses and scattered trees. Vine-mesquite makes up about 15 percent of the climax plant community, sideoats grama 15 percent, western wheatgrass 15 percent, Texas wintergrass 10 percent, blue grama 5 percent, Arizona cottontop 5 percent, meadow dropseed 5 percent, silver bluestem 5 percent, white tridens 5 percent, Canada wildrye 5 percent, buffalograss 5 percent, woody species 5 percent, and forbs 5 percent. Among the climax woody species are hackberry, ephedra, American elm, bumelia, and western soapberry. Among the climax forbs are heath aster, Englemanndaisy, dotted gayfeather, verbena, wild onion, trailing ratany, Maximilian sunflower, gaura, thelesperma, and oenothera.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,500 pounds to 4,500 pounds per acre, depending on the amount of rainfall. About 90 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, western wheatgrass, side-oats grama, and vine-mesquite decrease, and buffalograss, white tridens, Texas winter-grass, and meadow dropseed increase. Upon further deterioration of the site, buffalograss dominates, and mesquite, pricklypear, and annuals invade.

DUNE RANGE SITE

This site consists of undulating to rolling, deep and sandy soils that commonly have areas of unstabilized dunes. Permeability is rapid, and available water capacity is low. The hazard of soil blowing is severe, and the hazard of water erosion is slight. Herbage produced is low in nutrients.

The climax plant community consists of a tall-grass prairie. Indiangrass makes up about 20 percent of the climax plant community, sand bluestem 25 percent, giant dropseed 10 percent, little bluestem 10 percent, switchgrass 5 percent, sand lovegrass 5 percent, silver bluestem 5 percent, side-oats grama, plains bristle-grass, and sand dropseed 10 percent, weedy species 5 percent, and forbs 5 percent. Some climax woody species are prickly-ash, sand sagebush, skunkbush sumac, sandplum, hackberry, and western soapberry. Some climax forbs are partridgepea, trailing wildbean, bush morningglory, and oenothera.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 pounds to 2,000 pounds per acre, depending on the amount of rainfall. About 85 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, tall grasses decrease, and the mid grasses and short grasses increase. Sand sagebush and yucca are woody species that increase. Upon further deterioration of the site, sand sagebush that has a grass understory of red love-grass, gummy lovegrass, sand paspalum, hooded windmillgrass, and sand dropseed dominate. Mesquite and pricklypear invade to a limited extent.

LOAMY BOTTOMLAND RANGE SITE

This site consists of nearly level, deep fine sandy loams, very fine sandy loams, silt loams, and clay loams on flood plains along the rivers, creeks, and small tributaries. Permeability is moderate and moderately rapid, and available water capacity is medium to high. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The climax plant community consists of mid grasses and tall grasses. Indiangrass makes up about 15 percent of the climax plant community, sand bluestem 15 percent, switchgrass 10 percent, little bluestem 10 percent, Canada wildrye 5 percent, western wheatgrass 5 percent, vine-mesquite 5 percent, side-oats grama 5 percent, Texas wintergrass 5 percent, woody species 15 percent, and forbs 10 percent. Among the climax forbs are Englemanndaisy, heath aster, Maximilian sunflower, sagewort, gaura, greenthread, Illinois bundleflower, verbena, and pitcher sage. Among the climax woody species are American elm, hackberry, cottonwood, greenbriar, post oak, pecan, wild plum, bumelia, hawthorn, cedar elm, Carolina snailseed, skunkbush sumac, and western soapberry.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 3,000 to 7,000 pounds per acre, depending on the amount of rainfall. About 85 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, tall grasses and decreaser forbs are replaced by buffalo-grass, white tridens, and sand dropseed. Mesquite, pricklypear, and lotebush condalia invade. The soils of this site respond favorably to mechanical brush control and reseeding.

MIXEDLAND RANGE SITE

This site consists of nearly level to moderately steep loams and very fine sandy loams. Permeability is moderate or moderately rapid, and available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is slight to severe.

The climax plant community consists of a mid-grass prairie. Scattered tall grasses grow in areas of favorable moisture. Side-oats grama makes up about 20 percent of the climax plant community, little bluestem 15 percent, blue grama 10 percent, buffalograss 10 percent, plains bristlegrass 5 percent, Arizona cottontop 5 percent, vine-mesquite 5 percent, silver bluestem 5 percent, sand dropseed 5 percent, Texas wintergrass 5 percent, Wright and purple three-awn 5 percent, woody species 5 percent, and forbs 5 percent. Among the climax forbs are skeleton plant, primrose, trailing ratany, mentzelia, groundcherry, heath aster, sagewort, Englemanndaisy, and catclaw sensitivebriar. Among the climax woody species are skunkbush sumac, hackberry, elbowbush, prickly-ash, and ephedra.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,700 pounds to 3,300 pounds per acre, depending on the amount of rainfall. About 90 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, side-oats grama and little bluestem decrease, and buffalograss, sand dropseed, and three-awn increase. Upon further deterioration of the site, mesquite, tasajillo, prickly-pear, hairy tridens, red grama, and sand muhly invade.

ROCKY HILLS RANGE SITE

This site consists of sloping to steep, shallow, stony clays. Limestone rocks cover as much as 25 percent of the surface in some areas. Permeability is very slow, and available water capacity is low. The hazard of soil blowing is slight, and the hazard of water erosion is severe.

The climax plant community consists of mid grasses and tall grasses and scattered trees. Side-oats grama makes up about 25 percent of the climax plant community, big bluestem 20 percent, indiangrass 15 percent, little bluestem 10 percent, Texas wintergrass 5 percent, rough tridens 5 percent, Arizona cottontop 5 percent, forbs 5 percent, and woody species 10 percent. Among the climax forbs are heath aster, gaura, sagewort, buckwheat, Englemanndaisy, Maximilian sun-flower, and plains blackfoot. Among the climax woody plants are skunkbush sumac, littleleaf sumac, feather dalea, hackberry, elm, bumelia, plum, prickly-ash, cat-claw sensitivebriar, and ephedra.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 pounds to 1,800 pounds per acre, depending on the amount of rainfall. About 80 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, tall-grasses decrease, and the mid grasses and short grasses increase. Because of steepness of slope, active erosion takes place when heavy grazing removes the plant cover. Side-oats grama and buffalograss increase and persist, even under heavy grazing.

SANDY BOTTOMLAND RANGE SITE

This site consists of nearly level to gently sloping, alluvial fine sandy loams and loamy fine sands on flood plains that generally have a water table at a depth of less than 6 feet. Permeability is rapid, and available water capacity is low. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

The climax plant community consists of tall grasses. Indiangrass makes up about 20 percent of the climax plant community, sand bluestem 20 percent, switchgrass 15 percent, little bluestem 15 percent, western wheatgrass 5 percent, Canada wildrye 5 percent, giant dropseed 5 percent, sand lovegrass 5 percent, perennial forbs 5 percent, and woody species 5 percent. Among the climax forbs are partridgepea, western indigo, Maximilian sunflower, prairie clover, pitcher sage, heath aster, trailing wildbean, and Illinois bundleflower. Among the climax woody species are wild plum, bumelia, hackberry, western soapberry, prickly-ash, cottonwood, skunkbush sumac, and ephedra.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 pounds to 3,000 pounds per acre, depending on the amount of rainfall. About 95 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, tall grasses are grazed out, and the site develops into a mid-grass and short-grass site. Little bluestem remains until complete deterioration occurs. Baccharis, mesquite, and saltcedar are invader trees. Sand dropseed, alkali sacaton, prairie three-awn, hooded windmillgrass, and gummy lovegrass are invader grasses (fig. 28).

Figure 28.—An area of Lincoln soils, frequently flooded, in the Sandy Bottomland range site.

SANDY LOAM RANGE SITE

This site consists of nearly level to gently sloping fine sandy loams to loamy fine sands. Permeability is moderate to moderately rapid, and available water capacity is low to high. The hazard of soil blowing is moderate to severe, and the hazard of water erosion is slight to moderate.

The climax plant community consists of a mid-grass prairie. Little bluestem makes up about 25 percent of the climax plant community, side-oats grama 20 percent, plains bristlegrass 10 percent, Arizona cottontop 10 percent, vine-mesquite 10 percent, hooded windmill-grass 5 percent, buffalograss 5 percent, blue grama 5 percent, forbs 5 percent, and woody species 5 percent. Among the climax forbs are western ragweed, Englemanndaisy, primrose, guara, dotted gayfeather, wild onion, sagewort, windflower, heath aster, and catclaw sensitivebriar. Among the climax woody species are yucca, hackberry, bumelia, skunkbush sumac, ephedra, and pricklyash.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,800 pounds to 3,000 pounds per acre, depending on the amount of rainfall. About 90 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, mesquite, pricklypear, and lotebush condalia invade. Sand drop-seed, fall witchgrass, buffalograss, three-awn, and silver bluestem become primary grasses. The soils of this site respond favorably to mechanical brush control and reseeding.

SHALLOW CLAY RANGE SITE

This site consists of gently sloping to moderately steep, very shallow to moderately deep clay loams and clays. Permeability is very slow, and available water capacity is low. The hazard of soil blowing is slight, and the hazard of water erosion is moderate to severe.

The climax plant community consists of short grasses and mid grasses. Side-oats grama makes up about 35 percent of the climax plant community, buffalograss 10percent, vine-mesquite 5 percent, Arizona cottontop 5 percent, silver bluestem 5 percent, hairy grama 5 percent, blue grama 5 percent, little bluestem 5 percent, rough tridens 5 percent, Texas wintergrass 5 percent, Wright and purple three-awn 5 percent, forbs 5 percent, and woody species 5 percent. Among the climax forbs are verbena, greenthread, trailing ratany, dotted gayfeather, western ragweed, skeleton plant, and tetraneuris. Among the climax woody species are ephedra, wolfberry, feather dalea, catclaw acacia, hackberry, and four-wing saltbush.

If this site is in excellent condition, the total annual yield of air-dry herbage rages from 800 pounds to 1,700 pounds per acre, depending on the amount of rainfall. About 90 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, side-oats grama, vine-mesquite, and Arizona cottontop decrease, and buffalograss increases. Upon further deterioration of the site, buffalograss is replaced by hairy tridens, sand dropseed, sand muhly, and Texas grama, while mesquite, lotebush condalia, and pricklypear invade (fig. 29).

Figure 29.—An area of Owens-Knoco complex, 3 to 15 percent slopes, in the Shallow Clay range site.

TIGHT SANDY LOAM RANGE SITE

This site consists of gently sloping, moderately deep loams. Permeability is moderately slow, and available water capacity is medium. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The climax plant community consists of a mid-grass prairie. Side-oats grama makes up about 30 percent of the climax plant community, Arizona cottontop 15 percent, vine-mesquite 15 percent, blue grama 10 percent, buffalograss 10 percent, Wright and purple three-awn 5 percent, Texas wintergrass 5 percent, silver blue-stem 5 percent, and forbs 5 percent. Among the climax forbs are western ragweed, trailing ratany, Englemanndaisy, dotted gayfeather, heath aster, and catclaw sensitivebriar.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 pounds to 3,000 pounds per acre, depending on the amount of rainfall. About 95 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, side-oats grama, vine-mesquite, and Arizona cottontop decrease, and buffalograss becomes the dominant grass. Mesquite and lotebush condalia, sand dropseed, and gummy love-grass invade. The soils of this site respond favorably to mechanical brush control and reseeding.

VERY SHALLOW RANGE SITE

This site consists of sloping to moderately steep, very shallow to shallow fine sandy loams. Permeability is moderate, and available water capacity is low. The hazard of soil blowing is moderate, and the hazard of water erosion is severe.

The climax plant community consists of a mixture of short grasses, mid grasses, and tall grasses, with mid grasses dominating. Vegetation is generally sparse. Side-oats grama makes up about 30 percent of the climax plant community, little bluestem 15 percent, Texas wintergrass 5 percent, hairy grama 5 percent, indiangrass 5 percent, buffalograss 5 percent, silver bluestem 5 percent, rough tridens 5 percent, purple and Wright three-awn 5 percent, woody species 5 percent, and perennial forbs 15 percent. Among the climax wood species are feather dalea, hackberry, catclaw acacia, ephedra, skunkbush sumac, and bumelia. Among the climax forbs are plains blackfoot, dotted gayfeather, Englemanndaisy, bush sunflower, skullcap, plains zinnia, gray gold-aster, greenthread, sagewort, and Indian mallow.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 600 pounds to 1,200 pounds per acre, depending on the amount of rainfall. About 85 percent of this yield consists of plants that provide forage for livestock.

Under continued heavy grazing of this site, indiangrass, side-oats grama, and the climax forbs decrease, and three-awns, buffalograss, and hairy grama increase. Mesquite, hairy tridens, red grama, and broom snakeweed invade. Because of steepness of slope and shallowness of the soils of this site, mechanical treatment is hazardous.

Engineering Uses of Soils

John Adams, civil engineer, Soil Conservation Service, assisted in preparing this section.

This section is useful to those who need information about soils used as structural material or as foundations upon which structures are built. Among those who can benefit from this section are planning commissioners, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compaction characteristics, compressibility, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 3, 4, and 5, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 4, and can also be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially of small ones, is needed, because many delineated areas of a given soil may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for engineering.

Some of the terms used in this soil survey have meanings different in soil science than in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering soil classification systems

United States Department of Defense. Unified soil classification system for roads, airfields, embankments and foundations. MIL-STD-619B, 30 pp., illus. 1968.

American Association of State Highway Officials. Standard specifications for highway materials and methods of sampling and testing, Ed. 8, 2 vol, illus. 1961.

The two systems most commonly used in classifying samples of soils for engineering are the Unified soil classification system, used by SCS engineers, the Department of Defense, and others, and the AASHO system, adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped into 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL.

The AASHO system is used to classify soils according to those properties that affect their use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups, ranging from A-1 through A-7, on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils

of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet, the poorest soils for subgrade. If laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b A-2-4, A-2-5, A-2-6, A-2-7, A-7-5. and A-7-6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 5; the estimated classification, without group index numbers, is given in table 3 for all soils mapped in the survey area.

Estimated properties significant to engineering

Several estimated soil properties significant to engineering are given in table 3. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. Estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 3.

Hydrologic soil groups give the runoff potential from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of storms of long duration, after prior wetting and opportunity for swelling, and without the protective effects of vegetation.

The major soil groups are:

A.—These soils have a high infiltration rate even when thoroughly wetted. They are chiefly moderately drained to excessively drained sands or gravels. These soils have a high rate of water transmission in that water readily passes through them. They have low runoff potential.

B.—These soils have a moderate infiltration rate when thoroughly wetted. They are chiefly moderately deep to deep, moderately well drained to well drained soils that are moderately fine to moderately coarse. These soils have a moderate rate of water transmission.

C.—These soils have a slow infiltration rate when thoroughly wetted. They are chiefly soils that have a layer that impedes downward movement of water or soils that are moderately fine to fine. These soils have a slow rate of water transmission.

D.—These soils have a very slow infiltration rate when thoroughly wetted. They are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission. They have high runoff potential.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Depth to water table is not given in table 3, because the soils in Wichita County are generally sufficiently deep over the water table that it does not affect their use.

Soil texture is described in table 3 in the standard terms used by the U.S. Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. “Loam,” for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, “gravelly loamy sand.” “Sand,” “silt,” “clay,” and some of the other terms in USDA textural classification are defined in the Glossary.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semi-solid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 3, but in table 5 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structures and texture. The estimates in table 3 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and terms used to describe reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material as it changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it is wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 3, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel. The rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures should be used to avoid or minimize damage. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. A column for concrete was not included because all the soils of Wichita County are rated low.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete.

Engineering interpretations of soils

The interpretations in table 4 are based on the estimated engineering properties of soils shown in table 3, on test data for soils in this survey area and in others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Wichita County. In table 4, ratings are used to summarize limitations or suitability of the soils for all listed purposes other than for irrigation, terraces and diversions, and waterways. For these particular uses, table 4 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use, or, in other words, limitations are minor and are easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Soil suitability is rated by the terms *good, fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 4.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to the water table or to rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risks of erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope, and if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amount of stones, if any, that influences the ease of excavation and compaction of the embankment material.

Shallow excavations require digging or trenching to a depth of less than 6 feet; for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings without basements, as rated in table 4, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 4 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but every site should nevertheless be investigated before it is selected.

Local roads and streets, as rated in table 4, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that generally affect the design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and the workability and quantity of cut-and-fill material available. The AASHO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect the stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and the amount of cut and fill material needed to reach an even grade.

Light industry is rated by the same factors as those important to dwellings. These are buildings of three stories or less. Slope is more important than for dwellings, and soils on steeper slopes are given more severe ratings for this use.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Pond embankments require soil material that is resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. The presence of stones or organic material in a soil are among factors that are unfavorable.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction; however, the suitability of the soils as a source of sand and gravel is not given in table 4, because only a few soils in Wichita County are sources of sand and gravel. Deep strata under Lincoln, Yahola, Yomont, and Clairemont soils are possible sources of sand and gravel.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and the absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that results in the area from which topsoil is taken.

Drainage of cropland and pasture is not rated in table 4 because only Clairemont soils, wet, Deandale soils, wet, Mangum soils, wet, Tillman and Deandale soils, saline, 0 to 3 percent slopes, and Winters loam, wet, need drainage. Drainage is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence the rate of water movement; depth to the water table; slope stability in ditchbanks; susceptibility to stream flooding; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream flooding, water erosion, or soil blowing; texture; content of stones; salinity or alkalinity; thickness of the root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; the amount of water available to plants; and the need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Suitability for grassed waterways is determined by the hazard of erosion and the amount of shaping that can be done, which in turn depends on slope, stoniness, and depth to bedrock and the difficulty in establishing vegetation. The hazard of flooding is also a factor affecting waterways.

Soil test data

Table 5 contains engineering test data for some of the major soil series in Wichita County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relationship between change in volume of the soil material and the water content of the soil material at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when ovendry.

Lineal shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Tests to determine *liquid limit* and *plastic limit* measure the effect of water on the consistence of soil material, as has been explained for table 3.

Recreation

A knowledge of soils is necessary in planning, developing, and maintaining recreational areas. In table 6 the soils of Wichita County are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

In table 6 the soils are rated as having slight, moderate, or severe limitations for specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can easily be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, or intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm when wet but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during periods of heavy use; and do not have slopes or stoniness that greatly increases the cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm when wet but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during periods of heavy use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Wildlife

Soils directly influence the kinds and amounts of vegetation and the amounts of water available, and in this way they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect wildlife habitat are: (1) suitability for crops, (2) surface texture, (3) available water capacity to a depth of 40 inches, (4) wetness, (5) surface stoniness or rockiness, (6) hazard of flooding, (7) slope, and (8) permeability of the soil to air and water.

In table 7 the soils of this survey area are rated according to their suitability for producing eight elements of wildlife habitat and for three groups, or kinds, of wildlife. A rating of *good* means that wildlife habitat is generally easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of *fair* means that wildlife habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention may be required for satisfactory results.

A rating of *poor* means that the limitations for the designated use are rather severe. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of *very poor* means that the limitations are very severe and that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitat on soils in this category.

The significance of each subheading in table 7 under “Elements of Wildlife Habitat” and “Kinds of Wildlife” is explained below:

Elements of wildlife habitat.—Each soil is rated in table 7 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitat. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present uses of soils, or present distribution of wildlife and people. For this reason, selection of a site for development as a habitat for wildlife requires onsite inspection.

Grain and seed crops are annual grain-producing plants, such as corn, sorghum, millet, and soybeans.

Grasses and legumes are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include bahiagrass, ryegrass, and panicgrass; legumes include annual lespedeza, shrub lespedeza, and other clover.

Wild herbaceous upland plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, perennial lespedeza, wild bean, pokeweed, and cheatgrass are typical examples. On range, typical plants are bluestem, grama, perennial forbs, and legumes.

Shrubs produce food for wildlife in the form of twigs, bark, buds, foliage, or browse. Such plants commonly grow in their natural environment, but they may be planted and developed through wildlife management programs. Typical species in this category are mesquite, catclaw, sagebrush, tasajillo, ephedra, lotebush, and skunkbush sumac.

Wetland food and cover plants are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover, mostly for wetland wildlife. Typical plants are smartwood, wild millet, spikerush and other rushes, sedges, bur-reed, tear-thumb, and aneilema. Submerged and floating aquatics are not included in this category.

Shallow-water developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitat suitable for water-fowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submerged aquatics.

Kinds of wildlife.—Table 7 rates soils according to their suitability as habitat for the three kinds of wildlife in the county—openland, rangeland, and wetland wildlife. These ratings are related to ratings made for the elements of wildlife habitat. For example, soils rated unsuited for shallow water developments are rated unsuited for wetland wildlife.

Openland wildlife consists of birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, dove, meadowlark, field sparrow, cottontail rabbit, and fox are typical of openland wildlife.

Rangeland wildlife consists of birds and mammals that generally live in native range. Scaled quail, bob-white quail, turkey, meadowlark, and lark bunting are examples of rangeland wildlife.

Wetland wildlife consists of birds and mammals that generally live in wet areas, marshes, and swamps. Duck, geese, rail, shore birds, heron, mink, and muskrat are examples of wetland wildlife.

Formation and Classification of the Soils

Udden, J.A., Baker, C.L., and Bose, Emil. Review of the geology of Texas. Univ. of Tex. Bull. 44, 164 pp., illus., 1916.

This section explains how soils form and the factors that are involved in their formation. It describes briefly the system of soil classification used in the United States and shows how the soils of Wichita County have been classified. Technical terms used in this section are defined in the Glossary.

Factors of Soil Formation

Soil is the product of the interaction of the five major factors of soil formation, which are parent material, climate, living organisms (especially vegetation), relief, and time. If one factor, such as climate or vegetation, is varied, a different soil is formed.

Several processes were involved in the formation of soil horizons in the soils of Wichita County. Three main processes are: (1) accumulation of organic matter, (2) leaching of calcium carbonates and bases, and (3) formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

Accumulation of organic matter in the upper profile to form an A1 horizon has been important. The soils of Wichita County range from medium to low in organic matter.

Leaching of carbonates and bases has taken place in nearly all of the soils. Soil scientists are generally agreed that leaching of bases in soils usually precedes translocation of silicate clay minerals. Most of the soils of the county are moderately to strongly leached, and this has contributed to the development of horizons. Calcium carbonates have been leached from the upper horizons of most of the soils. The amount of rainfall, however, has not been great enough to leach the carbonates entirely from the soil, and many of the soils have a layer in which calcium carbonates have accumulated.

In several soils of Wichita County, the downward translocation of clay minerals has contributed to horizon development. The Bt horizons contain appreciably more silicate clay than the A horizons. These soils were probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clays took place. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of Wichita County. Deandale, Frankirk, Kamay, and Rotan soils are examples of soils that have translocated silicate clays accumulated in the Bt horizons.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineralogical composition of the soils.

The soils in Wichita County formed in four kinds of parent material: (1) red-bed material, (2) old alluvium or outwash material, (3) recent eolian material, and (4) recent alluvial material.

The soils that formed in red beds are extensive throughout the central and extreme southern parts of the county. Soils that formed in clayey red beds are mainly of the Tillman, Kamay, Vernon, Deandale, Kirkland, and Renfrow series. Those that formed over sandstone or interbedded sandstone and clayey red beds are mainly of the Bluegrove, Cobb, Oben, and Latom series.

The soils that formed in old alluvial or outwash material are mainly in the northern part of the county, south of a band of eolian soils above the Red River flood plain in the east-central part of the county, and on each side of the flood plain of the Wichita River. This mantle of outwash was deposited over the red beds during the Pliocene and Pleistocene Periods.' The Grandfield, Motley, and Devol soils developed in the sandier material. Some of the Devol soils were probably reworked by wind. The Rotan, Winters, Frankirk, and Deandale, loamy substratum, soils formed in the clayey old alluvial or outwash material.

The soils that formed in eolian material are confined to an area about 1 to 3 miles wide across the northern part of the county, and above the flood plain of the Red River. These soils are of the Enterprise, Hardeman, and Tivoli series. The Enterprise soils formed in eolian very fine sand and silt, the Hardeman soils in fine sandy loam, and the Tivoli soils in fine sand.

The soils that formed in recent alluvial material are of the Clairemont, Lincoln, Mangum, Port, Asa, Yomont, and Yahola series. These soils are on the flood plains of streams throughout the county. The surface layers and subsurface layers of these soils are variable in texture, and the soils are mostly stratified.

Climate

The continental climate in Wichita County has promoted moderately rapid soil development. The climate is uniform throughout the county, although its effect is modified locally by runoff, and the differences between the soils are generally not due to climate.

Living organisms

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are among the changes caused by living organisms.

Vegetation, dominantly grasses, has affected soil formation in Wichita County more than animal life. The soils that formed under grass vegetation generally have a medium content of organic matter. Some of the young, sandy, and shallow soils are low in content of organic matter.

Relief

Relief affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. The topography of Wichita County ranges from nearly level to steep.

The soils that formed in nearly level to gently sloping positions, such as Tillman soils, are deeper and have more distinct horizons than soils, such as Vernon and Owens, that formed on gently sloping to sloping hilltops and ridges. This is because the soils in lower positions receive extra water, have less runoff, and are subject to less erosion.

On steep soils, if the parent material is sandstone or shale, geologic erosion occurs almost as fast as the soil material is formed. An example is the very shallow Latom soils. These soils have been forming as long as the less sloping Cobb and Oben soils but are shallower.

Time

Time, generally a long time, is required for formation of soils that have distinct horizons. The differences in length of time that parent material has been in place are commonly reflected in the degree of development of the soil profile.

The soils in Wichita County range from recent to well developed. The recent soils have very little profile development, and the well-developed soils have strongly differentiated horizons. Tivoli soils are an example of recent soils. Rotan soils are an example of soils that have well-developed horizons. They have been in place for a long time and have approached equilibrium with their environment.

Classification of Soils

United States Department of Agriculture. Soil classification, a comprehensive system, 7th approximation 265 pp., illus. 1960. [Supplements issued in March 1967 and September 1968.]

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to management. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest available literature.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Wichita County are placed in three categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDERS: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in sol (Ent-i-sol).

The four orders to which the soils of Wichita County belong are: Alfisols, Entisols, Inceptisols, and Mollisols.

Alfisols have a light-colored surface layer low in content of organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent.

Entisols have little or no evidence of development of pedogenic horizons.

Inceptisols have a light-colored surface layer low in content of organic matter, but do not have a clay-enriched B horizon.

Mollisols have a dark-colored surface layer high in content of organic matter, and have a base saturation of more than 50 percent.

SUBORDERS: Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is orthent (orth, meaning the most representative, and ent, from Entisol).

GREAT GROUPS : Soil orders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Torriorthents (Torr, meaning inadequate moisture, orth, for the most representative, and ent, from Entisols).

SUBGROUPS : Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Ustic Torriorthents.

FAMILIES: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, temperature, permeability, thickness of horizons, and consistency. A family name consists of a series of adjectives preceding the subgroup name. In table 8 the adjectives are the class name for texture, mineralogy, and so on that are used for family differentiae. An example is the clayey, mixed (calcareous), thermic, shallow family of Ustic Torriorthents.

Climate

By Robert B. Orton, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

Wichita County lies between the humid subtropical climate of east Texas and the continental climate to the north and west. The climate of Wichita Falls is classified with the latter. It is characterized by rapid changes in temperature; marked extremes, both daily and annual; and rather erratic rainfall.

The county lies in the path of polar air masses that move down from the north during the winter. With the passage of cold fronts, or "northers," in fall and in winter, abrupt temperature drops, as much as 20° to 30° F. within an hour, sometimes occur. While the county is subject to a wide range of temperature, winters are generally mild. The normal temperature for the coldest month, January, is 42.8°. Subzero temperatures occur in about 1 year in 5. The record lowest temperature in Wichita Falls, -5°, occurred in January 1966; however, prior station locations indicate a reading of -12° in January 1947. The summers in Wichita Falls are generally of the continental type, characterized by low humidity and good wind movement. Maximum temperatures of more than 100° are frequent during the common long periods of hot weather. August has the highest normal temperature, 85.7°. The July normal is 85.6°, and that of June is 81.8°. The record high temperature, 113°, occurred in August 1964, equaling the record set in August 1936 at another station location. Table 9 gives a climatological summary of Wichita County.

The normal rainfall is 26.20 inches per year, but the distribution is so erratic that long dry periods are common. Several lakes in the area provide water for domestic, industrial, and irrigation purposes. The greater part of the rainfall comes in the form of showers, rather than general rains. More than 75 percent of the annual moisture occurs during the period from late in March to mid-November, but dry periods of 3 to 4 weeks can be expected during this time almost every year. While the dry conditions materially affect farming in this region, complete crop failure seldom results. Moderate flooding along Holliday Creek and the Wichita River, which run through Wichita Falls, occurs about once in each 10-year period. Snow is unimportant for moisture, averaging only 2 days a year, and measuring an inch or more.

Mean windspeed averages more than 11 miles per hour with southerly winds prevailing. Rather strong winds are observed in all months. While strong, gusty winds occur frequently, severe duststorms are rare. The most severe duststorms observed are brought in from the north and west. This area has excellent weather for flying, which is possible on all but a very few days of the year. Approximately 95 percent of the time, the ceiling is 1,000 feet or more and visibility is 3 miles or more.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are-

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sand-blast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity, or capillary capacity*.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineral, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common*, and *many*; size—*fine, medium*, and *coarse*; and contrast—*faint, distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid*.

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system, made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction.

In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: Very coarse sand (2.0 to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.05 to 0.002 millimeter); and clay (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure soil. The arrangement of primary soil particles into compound particles or clusters that are separated from
adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Substratum. Technically, the part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is non-friable, hard, nonaggregated, and difficult to till.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size and diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

Tables

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Asa silty clay loam, occasionally flooded	2,370	0.6	Mangum-Fluvents complex, severely eroded	380	.1
Asa and Port soils, frequently flooded	19,640	5.1	Mangum-Urban land complex	980	.2
Bluegrove loam, 1 to 3 percent slopes	21,870	5.6	Mangum soils, wet	670	.2
Bluegrove loam, 3 to 5 percent slopes	2,330	.6	Motley loam, 0 to 1 percent slopes	940	.2
Bluegrove-Urban land complex, 1 to 3 percent slopes	2,390	.6	Motley loam, 1 to 3 percent slopes	10,760	2.7
Clairemont silt loam	15,420	3.7	Motley loam, 3 to 5 percent slopes	2,380	.6
Clairemont-Urban land complex	1,110	.3	Oben fine sandy loam, 1 to 5 percent slopes	2,890	.8
Clairemont soils, wet	360	.1	Oil wasteland	4,060	1.0
Cobb fine sandy loam, 1 to 3 percent slopes	2,380	.6	Owens stony clay, 5 to 30 percent slopes	680	.2
Deandale silt loam, 0 to 1 percent slopes	10,380	2.6	Owens-Knoco complex, 3 to 15 percent slopes	9,510	2.4
Deandale silt loam, 1 to 3 percent slopes	4,890	1.2	Port silt loam	2,980	.8
Deandale silt loam, loamy substratum, 0 to 1 percent slopes	14,460	3.7	Renfrow loam, 0 to 1 percent slopes	670	.2
Deandale silt loam, wet	220	.1	Renfrow loam, 1 to 3 percent slopes	4,400	1.1
Deandale-Urban land complex	2,580	.7	Renfrow-Urban land complex, 0 to 3 percent slopes	500	.1
Devol loamy fine sand, 0 to 3 percent slopes	980	.2	Rotan loam, 0 to 1 percent slopes	2,970	.8
Enterprise very fine sandy loam, 0 to 1 percent slopes	5,900	1.5	Rotan loam, 1 to 3 percent slopes	2,800	.7
Enterprise very fine sandy loam, 1 to 3 percent slopes	10,800	2.7	Tillman clay loam, 0 to 1 percent slopes	5,080	1.3
Enterprise very fine sandy loam, 3 to 5 percent slopes	2,460	.6	Tillman clay loam, 1 to 3 percent slopes	42,530	10.9
Enterprise very fine sandy loam, 5 to 8 percent slopes	880	.2	Tillman and Deandale soils, saline, 0 to 3 percent slopes	870	.2
Enterprise very fine sandy loam, 8 to 20 percent slopes	1,800	.5	Tipton loam, 0 to 1 percent slopes	3,120	.8
Frankirk loam, 0 to 1 percent slopes	4,630	1.2	Tipton-Urban land complex	680	.2
Frankirk loam, 1 to 3 percent slopes	7,750	2.0	Tivoli fine sand	1,220	.3
Grandfield fine sandy loam, 1 to 3 percent slopes	830	.2	Urban land	3,480	.9
Hardeman fine sandy loam, 1 to 3 percent slopes	3,420	.9	Vernon clay loam, 1 to 3 percent slopes	6,320	1.6
Hardeman fine sandy loam, 3 to 5 percent slopes	500	.1	Vernon clay loam, 3 to 5 percent slopes	7,400	1.9
Hollister clay loam, 0 to 1 percent slopes	2,070	.5	Vernon and Owens soils, 3 to 8 percent slopes	13,340	3.4
Kamay silt loam, 0 to 1 percent slopes	9,230	2.3	Waurika silt loam, 0 to 1 percent slopes	390	.1
Kamay silt loam, 1 to 3 percent slopes	49,860	12.9	Winters loam, 0 to 1 percent slopes	6,360	1.6
Kamay-Urban land complex, 0 to 3 percent slopes	3,400	.9	Winters loam, 1 to 3 percent slopes	9,290	2.4
Kirkland silt loam, 0 to 1 percent slopes	1,080	.3	Winters loam, 3 to 5 percent slopes	1,230	.3
Kirkland silt loam, 1 to 3 percent slopes	770	.2	Winters loam, wet	590	.1
Latom-Owens complex, 5 to 20 percent slopes	960	.2	Winters-Urban land complex, 0 to 3 percent slopes	3,250	.9
Latom-Urban land complex, 5 to 20 percent slopes	500	.1	Yahola and Yomont soils, frequently flooded	2,890	.7
Lincoln fine sandy loam	1,300	.3	Yomont very fine sandy loam	7,120	1.8
Lincoln soils, frequently flooded	4,110	1.0	Rivers and water areas	3,870	1.0
Mangum silty clay loam	8,360	2.1			
Mangum clay	4,370	1.1	Total	392,960	100.0

TABLE 2.—*Predicted yields per acre of principal crops*

[Absence of data indicates that the crop is not suited to or is not generally grown on the soil]

Soil	Cotton (lint)		Wheat		Bermudagrass	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated
	Pounds	*Pounds*	*Bu*	*Bu*	*Tons*	*Tons*
Asa silty clay loam, occasionally flooded	390		30		4.0	
Bluegrove loam, 1 to 3 percent slopes	250		25			
Bluegrove loam, 3 to 5 percent slopes	200		20			
Clairemont silt loam	390	500	30	40	4.0	10.0
Clairemont soils, wet				30	3.0	7.0
Cobb fine sandy loam, 1 to 3 percent slopes	225		20			
Deandale silt loam, 0 to 1 percent slopes	290		25		2.5	
Deandale silt loam, 1 to 3 percent slopes	240		20		2.0	
Deandale silt loam, loamy substratum, 0 to 1 percent slopes	290	450	25	30	2.5	9.0
Deandale silt loam, wet				20	2.5	6.0
Devol loamy fine sand, 0 to 3 percent slopes	230		20		3.5	
Enterprise very fine sandy loam, 0 to 1 percent slopes	350		25		3.0	
Enterprise very fine sandy loam, 1 to 3 percent slopes	300		20		2.5	
Enterprise very fine sandy loam, 3 to 5 percent slopes	250		15		2.5	
Enterprise very fine sandy loam, 5 to 8 percent slopes			15		2.0	
Frankirk loam, 0 to 1 percent slopes	300		30		2.5	
Frankirk loam, 1 to 3 percent slopes	250		25		2.0	
Grandfield fine sandy loam, 1 to 3 percent slopes	300	450	20	35	2.5	10.0
Hardeman fine sandy loam, 1 to 3 percent slopes	250		20		2.5	
Hardeman fine sandy loam, 3 to 5 percent slopes	225		15		2.5	
Hollister clay loam, 0 to 1 percent slopes	275		30		2.5	
Kamay silt loam, 0 to 1 percent slopes	290		25		2.5	
Kamay silt loam, 1 to 3 percent slopes	240		20		2.0	
Kirkland silt loam, 0 to 1 percent slopes	290		25		2.5	
Kirkland silt loam, 1 to 3 percent slopes	240		20		2.0	
Lincoln fine sandy loam			20		3.0	9.0
Lincoln soils, frequently flooded					2.5	7.5
Mangum silty clay loam	230	400	20	30	3.0	9.0
Mangum clay	150	200	15	25		7.0
Mangum soils, wet					2.0	5.0
Motley loam, 0 to 1 percent slopes	350		25		3.0	
Motley loam, 1 to 3 percent slopes	300		20		2.5	
Motley loam, 3 to 5 percent slopes	250		15		2.5	
Oben fine sandy loam, 1 to 5 percent slopes	200		15			
Port silt loam	400	500	30	40	4.0	10.0
Renfrow loam, 0 to 1 percent slopes	290		25		2.5	
Renfrow loam, 1 to 3 percent slopes	240		20		2.0	
Rotan loam, 0 to 1 percent slopes	300		30		2.5	
Rotan loam, 1 to 3 percent slopes	250		25		2.0	
Tillman clay loam, 0 to 1 percent slopes	250		25			
Tillman clay loam, 1 to 3 percent slopes	220		20			
Tipton loam, 0 to 1 percent slopes	350		25		3.0	
Vernon clay loam, 1 to 3 percent slopes			15			
Vernon clay loam, 3 to 5 percent slopes			10			
Waurika silt loam, 0 to 1 percent slopes	290		25		2.5	
Winters loam, 0 to 1 percent slopes	300	500	30	35	2.5	9.0
Winters loam, 1 to 3 percent slopes	250	450	25	30	2.0	9.0
Winters loam, 3 to 5 percent slopes	200		20		2.0	
Winters loam, wet					2.0	6.0
Yomont very fine sandy loam	380	500	25	35	4.0	10.0

TABLE 3.—*Estimated soil properties significant to engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table. The symbol < means less than; the symbol > means more than]

Soil series and map symbols	Hydrologic soil group	Depth to bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity of uncoated steel	Salinity
					Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
		Inches	*Inches*				*Pct*							*Inches per hour*	*Inches per inch of soil*	*pH*			
*Asa: As, Aw	B	>120	0–18	Silty clay loam.	CL	A-6, A-4		100	98–100	95–100	70–95	30–40	9–25	0.6–2.0	0.17–0.19	7.4–8.4	Low	Moderate	None.
For Port part of Aw, see Port series.			18–60	Silt loam	CL	A-6, A-4		100	98–100	90–100	70–95	30–40	9–25	0.6–2.0	0.17–0.19	7.9–8.4	Low	Moderate	None.
*Bluegrove: BeB, BeC, BuB	C	20–40	0–8	Loam	CL or CL-ML	A-4 or A-6		100	98–100	80–99	51–70	18–30	4–12	0.6–2.0	0.10–0.18	5.6–7.3	Low	Low	None.
For Urban land part of BuB, see Urban land.			8–34	Clay loam	CL	A-6 or A-7		95–100	95–100	85–99	51–80	28–50	11–30	0.2–0.6	0.15–0.20	5.6–7.8	Moderate	Moderate	None.
			34–64	Weakly cemented sandstone.															
*Clairemont:																			
Ca, Cb	B	>120	0–26	Silt loam	CL	A-6 or A-4		100	100	100	85–95	28–40	9–25	0.6–2.0	0.16–0.19	7.9–8.4	Low	Low	None.
For Urban land part of Cb, see Urban land.			26–56	Silty clay loam.	CL	A-6 or A-4		100	100	100	85–95	28–40	9–25	0.6–2.0	0.16–0.19	7.9–8.4	Low	Moderate	None.
			56–90	Silt loam	CL or CL-ML	A-4 or A-6		100	100	100	65–75	23–40	5–20	0.6–2.0	0.16–0.18	7.9–8.4	Low	Low	Low.
Cc	B	>120	0–7	Silt loam	CL	A-6 or A-4		100	100	100	85–95	28–40	9–25	0.6–2.0	0.16–0.19	7.9–8.4	Low	High	None.
			7–23	Silty clay loam.	CL	A-6 or A-4		100	100	100	85–95	28–40	9–25	0.6–2.0	0.13–0.15	7.9–8.4	Low	Very high	Moderate.
			23–60	Silt loam.	CL	A-6 or A-4		100	100	100	85–95	28–40	9–25	0.6–2.0	0.10–0.12	7.9–8.4	Low	Very high	High.
Cobb: CoB	B	20–40	0–6	Fine sandy loam.	SM or SM-SC	A-4		98–100	98–100	75–85	36–49	15–25	1–5	2.0–6.0	0.10–0.14	6.1–7.3	Low	Low	None.
			6–32	Sandy clay loam.	CL or SC	A-6		94–100	85–99	85–98	40–60	25–36	12–20	0.6–2.0	0.12–0.16	6.1–7.8	Low	Moderate	None.
			32–40	Weakly cemented sandstone.															
*Deandale:																			
DaA, DaB	D	>120	0–12	Silt loam	CL, CL-ML	A-4 or A-6		100	100	95–100	70–95	20–40	5–25	0.6–2.0	0.16–0.20	6.1–7.8	Low	Moderate	None.
			12–90	Clay	CL,CH	A-6 or A-7		95–100	95–100	95–100	70–95	35–60	20–40	<0.06	0.13–0.17	6.6–8.4	High	High	None to high.
DbA, Dd	D	>120	0–8	Silt loam	CL, CL-ML	A-4 or A-6		100	100	95–100	70–95	20–40	5–25	0.6–2.0	0.16–0.20	6.1–7.8	Low	Moderate	None.
For Urban land part of Dd, see Urban land.			8–74	Clay	CL, CH	A-6 or A-7		95–100	95–100	95–100	70–95	33–60	17–40	<0.06	0.13–0.17	6.6–8.4	High	High	None.
			74–86	Clay loam	CL	A-6		100	100	85–95	51–70	25–40	11–20	0.2–0.6	0.12–0.16	7.9–8.4	Moderate	High	Low.
			86–100	Sandy clay loam.	CL	A-6		100	98–100	80–100	51–70	25–40	11–20	0.6–2.0	0.12–0.16	7.9–8.4	Low	High	Low.
Dc	D	>120	0–6	Silt loam	CL,CL-ML	A-4 or A-6		100	100	95–100	70–95	20–40	5–25	0.6–2.0	0.14–0.18	6.1–7.8	Low	High	Low.
			6–76	Clay	CL, CH	A-6 or A-7		95–100	95–100	95–100	70–95	35–60	20–40	< 0.06	0.11–0.14	6.6–8.4	High	Very high	Moderate.
			76–96	Clay loam	CL	A-6		100	98–100	80–100	51–70	25–40	11–20	0.6–2.0	0.07–0.10	7.9–8.4	Low	Very High	Moderate.
Devol: DvB	B	>120	0–14	Loamy fine sand.	SM	A-2-4		100	100	70–85	15–30	<20	NP[1]–3	2.0–6.0	0.06–0.09	6.6–7.8	Very low	Low	None.
			14–50	Fine sandy loam.	SM, SM-SC, ML, or CL-ML	A-2-4 or A-4		100	100	70–85	30–60	17–22	2–6	2.0–6.0	0.11–0.14	6.6–7.8	Low	Low	None.
			50–72	Loamy fine sand.	SM	A-2-4		100	100	70–85	15–30	<20	NP–3	2.0–6.0	0.06–0.09	7.4–8.4	Very low	Low	None.
Enterprise: EnA, EnB, EnC, EnD, EnE.	B	>120	0–84	Very fine sandy loam.	ML or CL-ML	A-4		100	100	95–99	80–90	20–28	1–7	2.0–6.0	0.18–0.20	7.9–8.4	Low	Low	None.

TABLE 3.—*Estimated soil properties significant to engineering*—Continued

Soil series and map symbols	Hydrologic soil group	Depth to bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity of uncoated steel	Salinity
					Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
		Inches	*Inches*				*Pct*							*Inches per hour*	*Inches per inch of soil*	*pH*			
Fluvents. Mapped only in a complex with Mangum soils. Too variable to be rated.																			
Frankirk: FrA, FrB	C	>120	0–7	Loam	CL	A-6, A-4		100	100	95–100	75–90	25–35	8–20	0.6–2.0	0.15–0.18	6.1–7.4	Low	Low	None.
			7–55	Clay, clay loam.	CL	A-6 or A-7		98–100	98–100	90–100	65–90	35–50	18–26	0.2–0.6	0.15–0.20	6.6–8.3	Moderate	Moderate	None.
			55–70	Clay loam	CL	A-6		98–100	98–100	90–100	65–90	25–40	11–25	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate	None.
Grandfield: GfB	B	>120	0–6	Fine sandy loam.	ML, CL-ML, SM, or SM-SC	A-2-4 or A-4		100	100	90–100	30–60	<26	NP–6	2.0–6.0	0.09–0.13	6.1–7.3	Low	Low	None.
			6–56	Sandy clay loam.	CL, CL-ML, SC, or SM-SC	A-4 or A-6		100	100	90–100	40–60	20–35	5–15	0.6–2.0	0.12–0.16	6.1–8.4	Low	Moderate	None.
			56–80	Fine sandy loam.	ML, CL-ML, SM, or SM-SC	A-2-4 or A-4		100	100	90–100	30–60	<26	NP–6	2.0–6.0	0.09–0.13	7.4–8.4	Low	Low	None.
Hardeman: HaB, HaC	B	>120	0–96	Fine sandy loam.	ML, CL-ML, SM, or SM-SC	A-4		100	90–100	70–95	40–65	<30	NP–7	2.0–6.0	0.10–0.15	6.6–8.4	Low	Low	None.
Hollister: HoA	D	>120	0–9	Clay loam	CL	A-6 or A-7		100	100	100	85–99	35–45	12–25	0.06–0.2	0.14–0.18	6.6–7.3	Moderate	Moderate	None.
			9–90	Clay	CL, CH	A-7		100	95–100	90–100	80–98	41–60	20–40	0.06–0.2	0.15–0.19	7.4–8.4	High	High	None.
*Kamay: KaA, KaB, KcB. For Urban land part of KcB, see Urban land.	D	>120	0–10	Silt loam	CL, CL-ML	A-4 or A-6		100	100	95–100	70–90	22–40	5–20	0.6–2.0	0.16–0.20	6.6–7.3	Low	Low	None.
			10–100	Clay, clayey shale.	CL, CH	A-6 or A-7-6		100	100	95–99	70–98	38–55	19–35	<0.06	0.13–0.17	6.6–8.4	High	High	None.
Kirkland: KrA, KrB	D	>120	0–9	Silt loam	CL, ML, or CL-ML	A-4, A-6 or A-7		100	100	96–100	70–90	21–45	5–20	0.6–2.0	0.16–0.20	6.1–7.3	Low	Low	None.
			9–78	Clay	CL, CH	A-6 or A-7-6		100	100	96–100	70–99	35–65	15–40	<0.06	0.13–0.17	6.6–8.4	High	High	None.
			78–100	Clayey shale.	CL or CH	A-7, A-6		95–100	95–100	85–95	55–80	35–55	25–35	<0.06	0.03–0.08	7.9–8.4	Moderate	High	None.
Knoco. Mapped only in complex with Owens soils.	D	3–8	0–5	Clay	CL or CH	A-7	0–10	90–100	90–100	90–100	80–98	45–60	20–30	<0.06	0.12–0.17	7.9–8.4	High	High	None.
			5–20	Clayey shale.	CL, CH	A-7		90–100	85–100	80–90	60–90	41–60	20–35	<0.06	0.03–0.08	7.9–8.4	Low	High	None.
*Latom: LaE, LcE. For Owens part of LaE, see Owens Series. For Urban land part of LcE, see Urban land.	D	4–14	0–8	Fine sandy loam.	SM or SM-SC	A-2-4	0–5	90–100	85–95	80–90	25–35	15–25	2–7	0.6–2.0	0.10–0.14	7.9–8.4	Low	Low	None.
			8–20	Strongly cemented sandstone.															
Lincoln: Ln, Lw	A	>120	0–12	Fine sandy loam.	SM or SM-SC	A-4, A-2-4		90–100	85–100	75–95	30–49	<26	NP–6	6.0–20.0	0.10–0.15	7.4–8.4	Low	Very low	None.
			12–60	Fine sand	SM	A-2-4		90–100	90–100	75–100	15–30		NP	6.0–20.0	0.05–0.10	7.9–8.4	Very low	Very low	None to low.

TABLE 3.—*Estimated soil properties significant to engineering*—Continued

Soil series and map symbols	Hydrologic soil group	Depth to bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity of uncoated steel	Salinity
					Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
		Inches	*Inches*				*Pct*							*Inches per hour*	*Inches per inch of soil*	*pH*			
*Mangum:																			
Ma, Mc, Me, Mf	D	>120	0–7	Silty clay loam, clay.	CL	A-6 or A-7		100	100	100	90–100	30–48	11–25	0.2–0.6	0.16–0.19	7.9–8.4	Moderate	Moderate	None.
For Fluvents part of Me, see Fluvents.																			
For Urban land part of Mf, see Urban land.			7–72	Clay	CL, CH	A-7		100	100	95–100	95–100	48–70	25–40	<0.06	0.14–0.16	7.9–8.4	High	High	Low to high.
Mg	D	>120	0–44	Clay	CL or CH	A-7		100	100	95–100	95–100	48–70	25–40	<0.06	0.10–0.13	7.9–8.4	High	Very high	Low to high.
			44–60	Silty clay loam.	CL	A-6 or A-7		100	100	100	90–100	30–48	11–25	0.2–0.6	0.09–0.12	7.9–8.4	Low	Very high	Low to very high.
Motley: MoA, MoB, MoC	B	>120	0–9	Loam	CL or CL-ML	A-4 or A-6		100	98–100	90–98	60–75	20–30	5–15	2.0–6.0	0.12–0.16	6.6–7.8	Low	Low	None.
			9–83	Sandy clay loam.	CL	A-6		100	95–100	90–98	70–85	30–40	15–25	0.6–2.0	0.13–0.17	6.6–8.4	Low	Moderate	None.
			83–92	Loam	CL	A-6, A-4		90–100	90–100	80–90	50–75	20–35	10–20	0.6–2.0	0.12–0.16	7.9–8.4	Low	Low	None.
Oben: ObC	C	10–20	0–6	Fine sandy loam.	SM, ML, CL, SC, SM-SC, CL-ML	A-4	0–5	95–100	95–100	70–85	40–50	16–30	2–10	0.6–2.0	0.10–0.13	6.1–7.3	Low	Low	None.
			6–17	Sandy clay loam.	CL or SC	A-6	0–5	90–98	90–98	85–95	45–70	28–38	12–18	0.6–2.0	0.12–0.15	6.1–7.3	Low	Moderate	None.
			17–36	Weakly cemented sandstone.															
Oil wasteland: Oe. Too variable to be rated.																			
*Owens: OsF, OwE	D	12–20	0–14	Clay	CL, CH	A-7	0–5	95–100	95–100	90–100	80–95	45–60	20–30	<0.06	0.13–0.17	7.9–8.4	High	High	None.
For Knoco part of OwE, see Knoco series.			14–36	Clayey shale.	CL or CH	A-7, A-6	0–5	90–100	90–100	80–90	55–80	40–55	25–35	<0.06	0.03–0.08	7.9–8.4	Low	High	None.
Port: Po	B	>120	0–24	Silt loam	CL	A-4 or A-6		100	100	100	80–90	30–35	8–12	0.6–2.0	0.15–0.18	6.1–7.8	Low	Low	None.
			24–58	Silty clay loam.	CL	A-4, A-7, A-6		100	100	100	85–95	30–43	8–20	0.6–2.0	0.15–0.19	6.6–8.4	Moderate	Moderate	None.
			58–90	Silty clay	CH	A-7		100	100	95–100	90–100	50–70	25–40	<0.06	0.15–0.19	7.9–8.4	Moderate	High	None.
*Renfrow: ReA, ReB, RfB	D	>120	0–5	Loam	CL, ML, CL-ML	A-4		100	100	96–100	60–80	20–35	1–10	0.6–2.0	0.14–0.18	6.1–7.3	Low	Low	None.
For Urban land part of RfB, see Urban land.																			
			5–12	Clay loam	CL	A-6 or A-7													
			12–110	Clay	CL	A-6 or A-7		100	100	97–100	85–95	35–45	12–35	0.2–0.6	0.15–0.19	6.1–7.8	Moderate	Moderate	None.
								98–100	95–100	90–100	60–98	28–50	15–30	<0.06	0.14–0.18	7.4–8.4	High	High	None.
Rotan: RoA, RoB	C	>120	0–10	Loam	CL	A-4 or A-6		100	100	95–99	70–80	20–25	8–12	0.6–2.0	0.15–0.19	6.6–7.8	Low	Low	None.
			10–18	Clay loam	CL	A-6 or A-7		100	100	95–99	75–85	25–30	8–12	0.6–2.0	0.15–0.19	7.4–8.4	Moderate	Moderate	None.
			18–70	Clay	CL	A-7		100	100	95–99	80–95	45–49	25–30	0.2–0.6	0.14–0.18	7.4–8.4	High	High	None.
			70–90	Clay loam	CL	A-6 or A-7		100	90–100	90–98	75–90	35–45	20–30	0.2–0.6	0.13–0.15	7.9–8.4	Moderate	Moderate	None.
*Tillman:																			
TcA, TcB	C	>120	0–7	Clay loam	CL	A-6 or A-7		100	100	90–100	75–90	35–48	15–30	0.2–0.6	0.16–0.20	6.6–7.3	Moderate	Moderate	None.
			7–90	Clay	CL or CH	A-6 or A-7-6		95–100	95–100	90–98	70–95	39–55	20–35	0.06–0.2	0.14–0.18	7.4–8.4	High	High	None.
TfB	C	>120	0–4	Silty clay loam.	CL	A-6		100	100	95–98	70–90	35–40	15–20	0.6–2.0	0.08–0.10	6.6–7.8	Low	Very high	Moderate to very high.
For Deandale part, see Deandale series.																			
			4–75	Clay	CL or CH	A-6 or A-7		95–100	95–100	90–98	70–95	39–55	20–30	0.06–0.2	0.04–0.08	7.4–8.4	High	Very high	High to very high.
*Tipton: ToA, Tu	B	>120	0–16	Loam	CL or CL-ML	A-4 or A-6		100	100	90–100	55–85	20–30	4–15	0.6–2.0	0.12–0.16	6.6–7.8	Low	Low	None.
For Urban land part of Tu, see Urban land.			16–80	Clay loam	CL	A-6, A-4, A-7		100	100	90–100	70–95	25–40	10–25	0.6–2.0	0.15–0.19	7.4–8.4	Moderate	Moderate	None.

TABLE 3.—*Estimated soil properties significant to engineering*—Continued

Soil series and map symbols	Hydrologic soil group	Depth to bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity of uncoated steel	Salinity
					Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
		Inches	*Inches*				*Pct*							*Inches per hour*	*Inches per inch of soil*	*pH*			
Tivoli: Tv	A	>120	0–60	Fine sand	SM or SP-SM	A-2-4 or A-3		100	100	85–95	9–20		NP	6.0–20.0	0.04–0.06	6.6–8.4	Very low	Very low	None.
Urban land: Ua. Too variable to be rated.																			
*Vernon: VcB, VcC, VoD	D	20–36	0–7	Clay loam	CL, CL-ML	A-4, A-6, or A-7		95–100	90–100	90–100	65–90	24–48	5–25	0.2–0.6	0.13–0.17	7.9–8.4	High	Moderate	None.
For Owens part of VoD, see Owens series.			7–34	Clay	CL, CH	A-6 or A-7		95–100	90–100	90–100	80–95	35–60	20–40	<0.06	0.13–0.17	7.9–8.4	High	High	None.
			34–60	Clayey shale.	CL, CH	A-6 or A-7		90–100	85–100	65–100	65–96	35–60	20–40	<0.06	0.08–0.12	7.9–8.4	High	High	None.
Waurika: WaA	D	>120	0–18	Silt loam	CL, ML, CL-ML	A-4 or A-6		100	100	96–100	80–90	21–37	1–14	0.6–2.0	0.16–0.20	5.6–7.3	Low	High	None.
			18–80	Clay	CL, CH	A-7		100	100	96–99	90–99	41–65	20–40	<0.06	0.12–0.18	6.6–8.4	High	High	None.
*Winters: WnA, WnB, WnC, WuB	C	>120	0–7	Loam	CL, CL-ML	A-4 or A-6		100	98–100	75–100	60–80	20–30	7–15	0.6–2.0	0.15–0.19	6.6–7.8	Low	Low	None.
For Urban land part of WuB, see Urban land.			7–70	Clay	CL	A-6 or A-7-6		100	98–100	80–100	65–85	25–45	15–30	2.0–0.6	0.14–0.18	6.6–8.4	Moderate	Moderate	None.
			70–90	Clay loam	CL	A-6 or A-7		100	98–100	80–100	60–80	25–45	15–30	0.6–2.0	0.14–0.18	7.9–8.4	Moderate	Moderate	Low.
Ws	C	>120	0–7	Loam	CL, CL-ML	A-4 or A-6		100	98–100	75–100	60–80	20–30	7–15	0.6–2.0	0.12–0.15	6.1–7.8	Low	High	None to low.
			7–19	Clay loam	CL	A-6 or A-7		100	98–100	80–100	60–80	25–45	15–30	0.6–2.0	0.07–0.10	6.6–8.4	Moderate	High	Low to moderate.
			19–46	Clay	CL	A-6 or A-7		100	98–100	80–100	65–85	25–45	15–30	0.2–0.6	0.07–0.10	6.6–8.4	Moderate	Very high	Low to moderate.
			46–74	Sandy clay loam.	CL	A-6 or A-7		100	98–100	80–100	60–80	25–45	15–30	0.6–2.0	0.05–0.08	7.4–8.4	Low	Very high	Moderate to high.
*Yahola: Ya	B	>120	0–60	Fine sandy loam.	CL, ML, SM, SC, CL-ML, SM-SC	A-4		100	100	90–98	36–60	<30	NP–10	2.0–6.0	0.11–0.15	7.9–8.4	Low	Low	None.
For Yomont part, see Yomont series.																			
Yomont: Yo	B	>120	0–96	Very fine sandy loam, fine sandy loam.	ML, CL-ML, SM, or SM-SC	A-4		100	100	100	48–75	20–25	1–5	2.0–6.0	0.16–0.20	7.9–8.4	Low	Moderate	None.

[1]NP= Nonplastic.

TABLE 4.—*Interpretations of engineering properties of the soils*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Degree and kind of limitations for—					Degree and kind of limitations for—Continued				Suitability as source of—		Soil features affecting—		
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill[1]	Local roads and streets	Light industry	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Grassed waterways
*Asa:														
As	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods; low strength.	Severe: floods.	Moderate: seepage.	Moderate: piping.	Poor: low strength.	Fair: too clayey.	Floods	Not needed	Favorable.
Aw For Port part, see Port series.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: seepage.	Moderate: piping.	Poor: low strength.	Fair: thin layer of material.	Floods	Not needed	Not needed.
*Bluegrove: BeB, BeC, BuB For Urban land part of BuB, see Urban land.	Severe: depth to rock; percs slowly.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: shrink-swell.	Severe: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: depth to rock.	Moderate: thin layer of material.	Fair: shrink-swell.	Fair: thin layer of materal.	Slow intake	Favorable	Favorable.
*Clairemont:														
Ca, Cb For Urban land part of Cb, see Urban land.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: seepage.	Moderate: piping.	Poor: low strength.	Good	Floods	Not needed	Favorable.
Cc	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods; wetness.	Severe: floods; wetness.	Moderate: seepage.	Moderate: piping.	Poor: low strength.	Fair: thin layer of material.	Excess salt; floods; wetness.	Not needed	Excess salt; floods; wetness.
Cobb: CoB	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock; low strength.	Severe: depth to rock.	Moderate: low strength.	Slight	Severe: depth to rock.	Moderate: thin layer of material.	Fair: low strength.	Poor: thin layer of material.	Fast intake; slope.	Favorable	Favorable.
*Deandale:														
DaA, DaB, Dd For Urban land part of Dd, see Urban land.	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: thin layer of material.	Percs slowly.	Favorable	Favorable.
Dc	Severe: percs slowly.	Slight	Severe: too clayey; wetness.	Severe: shrink-well; wetness	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: thin layer of material.	Excess salt; wetness.	Wetness	Excess salt; wetness.
Devol: DvB	Slight[1]	Severe: seepage.	Severe: cutbanks cave.	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.	Moderate: piping.	Good	Poor: too sandy.	Droughtiness; fast intake.	Too sandy	Not needed.
Enterprise:														
EnA, EnB, EnC	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.	Moderate: low strength.	Slight	Severe: seepage.	Moderate: piping.	Fair: low strength.	Good	Favorable	Favorable	Favorable.
EnD	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.	Moderate: low strength.	Moderate: slope.	Severe: seepage.	Moderate: piping.	Fair: low strength.	Good	Slope	Slope	Slope.
EnE	Moderate: slope.	Severe: seepage.	Moderate: slope.	Moderate: slope.	Severe: seepage.	Moderate: low strength; slope.	Severe: slope.	Severe: seepage.	Moderate: piping.	Fair: low strength.	Fair: slope	Slope	Slope	Slope.
Fluvents. Mapped only in complex with Mangum soils. Too variable to be rated.														
Frankirk: FrA, FrB	Severe: percs slowly.	Slight	Moderate: too clayey.	Moderate: low strength; shrink-swell.	Moderate: too clayey.	Moderate: low strength; shrink-swell.	Moderate: shrink-swell.	Moderate: seepage.	Moderate: piping.	Fair: low strength; shrink-swell.	Fair: thin layer of material.	Favorable	Favorable	Favorable.
Grandfield: GfB	Slight	Moderate: seepage.	Slight	Slight	Slight	Moderate: low strength.	Slight	Moderate: seepage.	Moderate: piping.	Fair: low strength.	Fair: thin layer of material.	Fast intake	Erodes easily	Erodes easily.

TABLE 4.—*Interpretations of engineering properties of the soils*—Continued

Soil series and map symbols	Degree and kind of limitations for—					Degree and kind of limitations for—Continued				Suitability as source of—		Soil features affecting—		
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill[1]	Local roads and streets	Light industry	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Grassed waterways
Hardeman: HaB, HaC	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.	Severe: low strength.	Severe: floods.	Moderate: seepage.	Moderate: piping; shrink-swell.	Poor: low strength.	Good	Floods	Not needed	Floods.
Hollister: HoA	Severe: perces slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: thin layer of material.	Perces slowly.	Favorable	Favorable.
*Kamay: KaA, KaB, KcB For Urban land part of KcB, see Urban land.	Severe: perces slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Moderate: seepage.	Moderate: piping; shrink-swell.	Poor: low strength; shrink-swell.	Fair: thin layer of material.	Favorable	Favorable	Favorable.
Kirkland: KrA, KrB	Severe: perces slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: too clayey.	Perces slowly.	Favorable	Favorable.
Knoco Mapped only in a complex with Owens soils.	Severe: perces slowly.	Severe: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Poor: excess salt.	Excess salt	Favorable	Excess salt.
*Latom: LaE, LcE For Owens part of LaE, see Owens series. For Urban land part of LcE, see Urban land.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: seepage.	Moderate: piping.	Fair: shrink-swell.	Fair: thin layer of material.	Favorable	Favorable	Favorable.
Lincoln: Ln, Lw	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: slope.	Moderate: slope.	Severe: seepage.	Severe: piping; unstable fill.	Good	Poor: too sandy.	Droughty; erodes easily.	Not needed	Not needed.
*Mangum: Ma, Mf For Urban land part of Mf, see Urban land.	Severe: floods; perces slowly.	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength; shrink-swell.	Severe: low strength; shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: too clayey.	Slope; slow intake.	Favorable	Droughty; slope.
Mc	Severe: floods; perces slowly.	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: thin layer of material.	Slow intake; wetness.	Not needed	Perces slowly; wetness.
Me. For Fluvents part, see Fluvents. Too variable to be rated.														
Mg	Severe: floods; perces slowly.	Slight	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods.	Severe: low strength.	Moderate: shrink-swell.	Moderate: seepage.	Moderate: piping.	Fair: low strength; shrink-swell.	Fair: thin layer of material.	Favorable	Favorable	Favorable.
						Severe: low strength.	Moderate: shrink-swell.	Moderate: seepage.	Moderate: piping.	Fair: low strength; shrink-swell.	Fair: thin layer of material.	Slope	Favorable	Favorable.
Motley: MoA, MoB, MoC	Moderate: seepage.	Moderate: seepage.	Slight	Moderate: low strength	Slight	Severe: low strength.	Moderate: shrink-swell; wetness.	Moderate: seepage.	Moderate: piping.	Fair: low strength; shrink-swell.	Fair: thin layer of material; excess salt.	Excess salt; wetness.	Wetness	Excess salt; wetness.
Oben: ObC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: floods.	Severe: floods.	Severe: seepage.	Moderate: piping.	Fair: low strength.	Good	Floods	Not needed	Floods.
Oil wasteland: Oe. Too variable to be rated.														
*Owens: OsF, OwE For Knoco part of OwE, see Knoco series.	Severe: perces slowly.	Severe: slope.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Moderate: floods.	Severe: floods.	Severe: seepage.	Moderate: piping.	Fair: low strength.	Good	Floods	Not needed	Floods.

TABLE 4.—*Interpretations of engineering properties of the soils*—Continued

Soil series and map symbols	Degree and kind of limitations for—					Degree and kind of limitations for—Continued				Suitability as source of—		Soil features affecting—		
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill[1]	Local roads and streets	Light industry	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Grassed waterways
Port: Po	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Severe: floods.	Moderate: floods; seepage.	Moderate: low strength.	Slight	Severe: seepage.	Moderate: piping.	Fair: low strength.	Good	Fast intake	Erodes easily.	Erodes easily.
*Renfrow: ReA, ReB, RfB For Urban land part of RfB, see Urban land.	Severe: perces slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: too clayey.	Perces slowly.	Favorable	Favorable.
Rotan: RoA, RoB	Severe: perces slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: thin layer of material.	Perces slowly.	Favorable	Favorable.
*Tillman: TcA, TcB	Severe: perces slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: thin layer of material.	Perces slowly.	Favorable	Favorable.
TfB For Deandale part, see Deandale series.	Severe: perces slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Poor: too clayey.	Droughtiness; slope.	Depth to rock; slope.	Droughtiness; slope.
*Tipton: ToA, Tu For Urban land part of Tu, see Urban land.	Slight	Moderate: seepage.	Slight	Moderate: shrink-swell.	Moderate: too clayey.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer of material.	Poor: thin layer of material.	Fair: thin layer of material.	Droughtiness; slope.	Depth to rock; slope.	Droughtiness; slope.
Tivoli: Tv	Slight[1]	Severe: seepage.	Severe: cut-banks cave.	Moderate: slope.	Severe: seepage.	Severe: floods.	Severe: floods.	Severe: seepage.	Moderate: piping.	Good	Fair: thin layer of material.	Fast intake; floods.	Not needed	Not needed.
Urban land: Ua. Too variable to be rated.														
*Vernon: VcB, VcC, VoD For Owens part of VoD, see Owens series.	Severe: perces slowly.	Moderate: slope.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: floods; low strength; shrink-swell.	Severe: floods.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Fair: too clayey.	Floods; perces slowly.	Not needed	Perces slowly.
Waurika: WaA	Severe: perces slowly.	Slight	Severe: too clayey; wetness.	Severe: low strength; shrink-swell.	Severe: too clayey	Severe: floods; low strength; shrink-swell.	Severe: floods.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Poor: too clayey.	Floods; perces slowly.	Not needed	Perces slowly.
*Winters: WnA, WnB, WuB For Urban land part of WuB, see Urban land.	Severe: perces slowly.	Slight	Severe: too clayey.	Moderate: shrink-swell.	Severe: too clayey.	Severe: floods; low strength; shrink-swell.	Severe: floods; wetness.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Poor: too clayey.	Floods; perces slowly; wetness.	Not needed	Perces slowly; wetness.
WnC	Severe: perces slowly.	Moderate: slope.	Severe: too clayey.	Moderate: shrink-swell.	Severe: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: seepage.	Moderate: piping.	Fair: low strength.	Fair: thin layer of material.	Favorable	Favorable	Favorable
Ws	Severe: perces slowly.	Slight	Severe: too clayey; wetness.	Severe: wetness.	Severe: too clayey.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: thin layer of material.	Poor: thin layer of material.	Poor: thin layer of material.	Rooting depth; slope.	Depth to rock.	Depth to rock; slope.
*Yahola: Ya For Yomont part, see Yomont series.	Severe: floods.	Severe: floods; seepage.	Severe: floods.	Severe: floods.	Severe: floods.									
Yomont: Yo	Severe: floods.	Severe: seepage.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength; shrink-swell.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Poor: too clayey.	Droughty; slope.	Slope	Droughty; slope.

[1]Pollution is a hazard to water supply.

TABLE 5.—*Engineering test data*

[Data provided by the Texas State Highway Department (report number 71–152–R, for example) and the City of Wichita Falls (report number 72Tex–243–1–1, for example)]

Soil name and location	Parent material	Field sample No. and Texas report No.	Depth	Shrinkage		Mechanical analysis [1]								Liquid limit	Plasticity index	Classification [2]	
						Percentage passing sieve—					Percentage smaller than—					AASHO [3]	Unified [4]
				Ratio	Lineal	⅜ in.	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
			Inches														
Bluegrove loam:																	
In old field, 900 feet south and 1,000 feet west of the intersection of Windthorst Road and south Access Road of U.S. Highway No. 287. (Modal)	Interbedded sandstone and clayey red beds.	73Tex–243–1–1	0–8	1.78	1.2		100	99	98	56				22	4	A–4 (4)	CL-ML
		72Tex–243–1–2	8–24	1.83	9.3	100	99	99	95	59				34	18	A–6 (8)	CL
		72Tex–243–1–3	24–34	1.75	5.0	100	99	97	94	51				28	11	A–6 (3)	CL
In cultivated field, 1 mile west of Burkburnett on Texas Highway No. 240 to junction with Farm Road 369, 0.3 mile south on county road and 200 feet east into cultivated field. (More silty than modal)	Interbedded sandstone and clayey red beds.	71–158–R	0–10	1.76	3.3				99	66				24	6	A–4 (6)	CL-ML
		71–159–R	13–22	1.85	9.6				99	74				36	19	A–6 (12)	CL
		71–160–R	22–36	1.84	7.6					71				31	16	A–6 (9)	CL
Clairemont silt loam:																	
In cultivated field, 50 feet south and 1,200 feet west of intersection of 77 Ranch Road and Cottonwood Road. (Modal)	Calcareous, loamy alluvium.	72Tex–243–7–1	0–9	1.80	6.2					93	87	22	15	29	12	A–6 (9)	CL
		72Tex–243–7–2	9–44	1.87	7.4				100	93	85	24	19	29	14	A–6 (10)	CL
		72Tex–243–7–3	44–64	1.63	2.2					68	65	5	5	24	5	A–4 (7)	CL-ML
Deandale silt loam:																	
In range, 150 feet north and 0.5 mile east of the intersection of Farm Roads 368 and 2345. (Modal)	Ancient alluvium derived from red-bed clay and shale.	71–152–R	0–12	1.73	3.1					83	69	18	11	25	6	A–4 (8)	CL-ML
		71–153–R	12–22	1.95	15.3					88	78	47	40	48	28	A–7–6 (17)	CL
		71–154–R	55–75	1.89	11.4		99	97	96	70	59	34	29	38	23	A–6 (12)	CL
Deandale silt loam, loamy substratum:																	
In cropland, 290 feet north of road, 0.22 mile west of paved county road, 0.62 mile south of U.S. Highway No. 287 Business, 3 miles east of Iowa Park. (Modal)	Reworked sediment derived, in part, from clayey red beds.	71–149–R	0–8	1.78	4.8					92	75	24	18	27	10	A–4 (8)	CL
		71–150–R	8–22	1.94	15.3					95	87	50	43	50	27	A–7–6 (17)	CL
		71–151–R	66–74	2.02	15.5	99	98	97	96	89	79	49	40	46	30	A–7–6 (17)	CL
Deandale silt loam:																	
In range, 300 feet south of Airport Road, 0.35 mile west of its intersection with U.S. Highway No. 277 and 281. (Less clayey subsoil than modal)	Ancient alluvium derived from red-bed clay and shale.	72Tex–243–11–1	0–6	1.72	3.0			100	98	73				25	6	A–4 (8)	CL-ML
		72Tex–243–11–2	11–23	1.85	11.3			100	98	79				38	20	A–6 (12)	CL
		72Tex–243–11–3	25–58	1.99	14.9				100	85				42	26	A–7–6 (14)	CL
Deandale silt loam, loamy substratum:																	
In vacant lot, 100 feet west of Milby Street, 1,100 feet north of its intersection with Archer Street. (Less clayey subsoil than modal)	Reworked sediment derived, in part, from clayey red beds.	72Tex–243–14–1	0–6	1.65	3.8			100	99	84				28	8	A–4 (8)	CL
		72Tex–243–14–2	10–22	1.84	11.6			100	99	86				40	23	A–6 (13)	CL
		72Tex–243–14–3	48–78	1.78	7.7			100	96	73				33	17	A–6 (11)	CL
		72Tex–243–14–4	78–100	1.76	6.0			100	88	60				30	12	A–6 (6)	CL
Frankirk loam:																	
In cultivated field, 0.2 mile south and 0.1 mile west of Texas Highway No. 240, from a point 0.5 mile west of the junction of Texas Highway No. 240 and Farm Road 369, in Burkburnett. (Modal)	Loamy outwash material.	71–155–R	16–30	1.91	11.0				95	73				37	19	A–6 (12)	CL
		71–156–R	40–60	1.90	12.2	99	99	98	94	67				40	25	A–6 (12)	CL
		71–157–R	60–80	1.86	9.8	99	99	99	95	66				36	21	A–6 (10)	CL
Hollister clay loam:																	
In field, 1,600 feet east of Barnett Road, 4,500 feet north of its intersection with Farm Road 369. (Modal)	Permian red-bed clay and shale.	72Tex–243–5–1	0–5	1.90	12.8					85				39	21	A–6 (12)	CL
		72Tex–243–5–2	5–22	1.99	15.5		100	96	92	80				44	25	A–7–6 (15)	CL
		72Tex–243–5–3	56–77	2.06	18.0				100	88				49	29	A–7–6 (18)	CL
Kamay silt loam:																	
In range, 400 feet east of county road, from a point 0.7 mile north via county road from its intersection with Farm Road 2345, 3 miles west of the intersection of Farm Roads 2345 and 368, 8 miles north of Iowa Park. (Modal)	Ancient alluvium derived from red-bed clay and shale.	71–161–R	0–10	1.64	4.7					89				32	10	A–4 (8)	CL
		71–162–R	10–17	1.89	12.0				99	87				40	23	A–6 (13)	CL
		71–163–R	58–75	2.02	15.0				99	91				44	28	A–7–6 (16)	CL
In cultivated field, 480 feet west of U.S. Highway No. 281 and 277 Expressway, 800 feet north of its intersection with Airport Road. (Less clayey than modal)	Permian red-bed clay and shale.	72Tex–243–12–1	0–6	1.75	4.3					74				24	9	A–4 (8)	CL
		72Tex–243–12–2	13–27	1.95	14.0			100	96	74				40	19	A–6 (12)	CL
		72Tex–243–12–3	32–62	1.88	11.8			100	96	82				39	23	A–6 (13)	CL
Kirkland silt loam:																	
In range, 50 feet north of Rathgeber Road, 0.4 mile west of its intersection with U.S. Highway No. 281. (Modal)	Clayey and shaly red-bed material.	72Tex–243–16–1	0–6	1.74	4.0			100	98	70				24	7	A–4 (7)	CL-ML
		72Tex–243–16–2	9–17	1.87	14.5			100	96	72				46	26	A–7–6 (14)	CL
		72Tex–243–16–3	47–78	1.93	16.0			100	96	89				49	33	A–7–6 (18)	CL

TABLE 5.—*Engineering test data*—Continued

Soil name and location	Parent material	Field sample No. and Texas report No.	Depth	Shrinkage		Mechanical analysis[1]								Liquid limit	Plasticity index	Classification[2]	
						Percentage passing sieve—					Percentage smaller than—					AASHO[3]	Unified[4]
				Ratio	Lineal	⅜ in.	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
			Inches														
Mangum silty clay loam:																	
In cultivated field, 50 feet west of Cottonwood Road, 1,300 feet south of its intersection with 77 Ranch Road. (Modal)	Calcareous, clayey alluvial sediment.	72Tex-243-8-1	0–7	1.86	10.1					94	91	40	29	36	17	A–6 (11)	CL
		72Tex-243-8-2	7–59	1.91	17.2					99	95	68	48	54	32	A–7–6 (19)	CH
Mangum clay:																	
In cultivated field, 100 feet north of 77 Ranch Road, 2,600 feet east of its intersection with Cottonwood Road. (More clayey than modal)	Calcareous, clayey alluvial sediment.	72Tex-243-9-1	0–5	1.89	15.2			100	98	99	95	63	44	50	27	A–7–6 (17)	CL
		72Tex-243-9-2	5–72	1.89	18.0			100	99	99	98	77	64	57	37	A–7–6 (19)	CH
Renfrow loam:																	
In old field, 400 feet west of Windthorst Road, 2.16 miles south of its intersection with U.S. Highway No. 287. (Modal)	Ancient alluvium derived from red-bed clay and shale.	72Tex-243-3-1	0–5	1.73	2.4					63				23	5	A–4 (6)	CL-ML
		72Tex-243-3-2	12–34	1.95	12.8			100	98	69				38	21	A–6 (11)	CL
		72Tex-243-3-3	48–68	1.95	8.8	100	99	96	94	64				28	16	A–6 (8)	CL
Tillman clay loam:																	
In cultivated field, 200 feet north of Farm Road 369, 2,100 feet east of its intersection with Allendale Road. (Modal)	Permian red-bed clay and shale.	72Tex-243-4-1	0–7	1.84	10.0				100	84				35	17	A–6 (11)	CL
		72Tex-243-4-2	17–29	1.99	16.0		100	99	96	85				46	29	A–7–6 (17)	CL
		72Tex-243-4-3	59–72	2.01	18.5		100	98	94	83				52	31	A–7–6 (18)	CH
Tipton loam:																	
In old field, 1,800 feet south of the Northwest Field and Stream Clubhouse on Southwest Parkway. (Modal)	Loamy alluvial sediment.	72Tex-243-15-1	0–6	1.71	5.5			100	99	76				30	14	A–6 (9)	CL
		72Tex-243-15-2	19–39	1.85	8.8					73				27	12	A–6 (9)	CL
		72Tex-243-15-3	47–76	1.91	10.0			100	97	81				33	19	A–6 (12)	CL
Vernon clay loam:																	
In range, 50 feet north of north Access Road of U.S. Highway No. 287, 300 feet west of its intersection with Windthorst Road. (Modal)	Clayey and shaly, Permian redbeds.	72Tex-243-2-1	0–6	1.76	4.0	100	98	98	98	65				24	6	A–4 (6)	CL-ML
		72Tex-243-2-2	6–19	2.00	13.0					83				36	20	A–6 (12)	CL
		72Tex-243-2-3	24–60	1.92	14.6					96				46	30	A–7–6 (17)	CL
Winters loam:																	
In old field, 85 feet north of Lakeshore Road, 1,000 feet west of its intersection with Fairway Blvd. (Modal)	Loamy old stream alluvium or plains outwash.	72Tex-243-6-1	0–9	1.81	5.9				100	79				27	10	A–4 (8)	CL
		72Tex-243-6-2	9–25	1.81	13.0			100	96	83				41	20	A–7–6 (12)	CL
		72Tex-243-6-3	64–82	1.87	9.2				100	87				34	19	A–6 (12)	CL
Yomont very fine sandy loam:																	
In Lucy Park, 1,500 feet southwest of rock house. (Modal)	Calcareous, stratified, silty and loamy alluvial sediment.	72Tex-243-13-1	0–10	1.63	1.0				100	49	46	8	4	22	3	A–4 (3)	SM
		72Tex-243-13-2	10–30	1.69	2.0				100	73	64	12	9	23	4	A–4 (8)	CL-ML
		72Tex-243-13-2	30–80	1.65	0.8				100	70	30	6	5	21	1	A–4 (7)	ML

[1] Mechanical analyses according to the AASHO Designation T 88–57. Results by this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses data used in this table are not suitable for use in naming textural classes of soil.

[2] Unified and AASHO classifications made by SCS.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8) AASHO Designation M 145-49.

[4] Based on the Unified soil classification system, Technical Memorandum No. 3–357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

TABLE 6.—*Ratings and limitations of the soils for recreational areas*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
*Asa: As, Aw For Port part of Aw, see Port series.	Severe: floods	Moderate: floods	Severe: floods	Slight.
*Bluegrove: BeB, BeC, BuB For Urban land part of BuB, see Urban land.	Moderate: percs slowly.	Slight	Moderate; percs slowly; slope.	Slight.
*Clairemont:				
Ca, Cb For Urban land part of Cb, see Urban land.	Severe: floods	Moderate: floods	Severe: floods	Slight.
Cc	Severe: floods	Moderate: floods	Severe: floods	Moderate: wetness.
Cobb: CoB	Slight	Slight	Slight	Slight.
*Deandale:				
DaA, DaB, DbA, Dd For Urban land part of Dd, see Urban land.	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Dc	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly.	Moderate: wetness.
Devol: DvB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Enterprise:				
EnA, EnB	Slight	Slight	Slight	Slight.
EnC	Slight	Slight	Moderate: slope	Slight.
EnD	Slight	Slight	Severe: slope	Slight.
EnE	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Fluvents. Mapped only in complex with Mangum soils. Too variable to be rated.				
Frankirk: FrA, FrB	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Grandfield: GfB	Slight	Slight	Slight	Slight.
Hardeman:				
HaB	Slight	Slight	Slight	Slight.
HaC	Slight	Slight	Moderate: slope	Slight.
Hollister: HoA	Moderate: too clayey; percs slowly.	Moderate: too clayey.	Moderate: too clayey; percs slowly.	Moderate: too clayey.
*Kamay: KaA, KaB, KcB For Urban land part of KcB, see Urban land.	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Kirkland: KrA, KrB	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Knoco Mapped only in complex with Owens soils.	Severe: too clayey; percs slowly.	Severe: too clayey	Severe: too clayey; percs slowly.	Severe: too clayey.
*Latom: LaE, LcE For Owens part of LaE, see Owens series. For Urban land part of LcE, see Urban land.	Moderate: slope	Moderate: slope	Severe: slope; depth to rock.	Slight.
Lincoln:				
Ln	Severe: floods	Severe: floods	Moderate: floods	Slight.
Lw	Severe: floods	Severe: floods	Severe: floods	Slight.

TABLE 6.—*Ratings and limitations of the soils for recreational areas*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
*Mangum:				
Ma, Mf—For Urban land part of Mf, see Urban land.	Severe: floods; percs slowly.	Moderate: floods; too clayey.	Severe: floods; percs slowly.	Moderate: too clayey.
Mc	Severe: too clayey; percs slowly; floods.	Severe: too clayey.	Severe: too clayey; percs slowly; floods.	Severe: too clayey.
Me.—For Fluvents part, see Fluvents. Too variable to be rated.				
Mg	Severe: too clayey; floods; wetness; percs slowly.	Severe: too clayey.	Severe: too clayey; percs slowly; floods; wetness.	Severe: too clayey.
Motley:				
MoA	Slight	Slight	Slight	Slight.
MoB, MoC	Slight	Slight	Moderate: slope	Slight.
Oben: ObC	Slight	Slight	Severe: depth to rock.	Slight.
Oil wasteland: Oe.—Too variable to be rated.				
*Owens: OsF, OwE—For Knoco part of OwE, see Knoco series.	Severe: too clayey; percs slowly; slope.	Severe: too clayey; slope.	Severe: too clayey; percs slowly. slope.	Severe: too clayey.
Port: Po	Severe: floods	Moderate: floods	Moderate: floods	Slight.
*Renfrow: ReA, ReB, RfB—For Urban land part of RfB, see Urban land.	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Rotan: RoA, RoB	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
*Tillman:				
TcA, TcB	Moderate: percs slowly; too clayey.	Moderate: too clayey.	Moderate: percs slowly; too clayey.	Moderate: too clayey.
TfB—For Deandale part, see Deandale series.	Moderate: percs slowly; too clayey.	Moderate: too clayey.	Moderate: percs slowly; too clayey.	Moderate: too clayey.
*Tipton: ToA, Tu—For Urban land part of Tu, see Urban land.	Slight	Slight	Slight	Slight.
Tivoli: Tv	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Urban land: Ua.—Too variable to be rated.				
*Vernon: VcB, VcC, VoD—For Owens part of VoD, see Owens series.	Severe: percs slowly.	Moderate: too clayey.	Severe: slope; percs slowly.	Moderate: too clayey.
Waurika: WaA	Moderate: very slow permeability; wetness.	Moderate: wetness.	Moderate: very slow permeability; wetness.	Moderate: wetness.
*Winters:				
WnA, WnB, WnC, WuB—For Urban land part of WuB, see Urban land.	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Ws	Severe: wetness	Moderate: wetness.	Severe: wetness	Moderate: wetness.
*Yahola: Ya—For Yomont part, see Yomont series.	Severe: floods	Moderate: floods	Severe: floods	Moderate: floods.
Yomont: Yo	Severe: floods	Moderate: floods	Severe: floods	Moderate: floods.

TABLE 7.—*Suitability of the soils for wildlife habitat elements and kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow-water development	Openland	Rangeland	Wetland
Asa:									
As	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Aw	Poor	Fair	Fair	Good	Poor	Very poor.	Fair	Fair	Very poor.
For Port part, see Port series.									
Bluegrove: BeB, BeC, BuB	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
For Urban land part of BuB, see Urban land.									
Clairemont:									
Ca, Cb	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
For Urban land part of Cb, see Urban land.									
Cc	Fair	Good	Poor	Poor	Fair	Fair	Fair	Poor	Fair.
Cobb: CoB	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
Deandale:									
DaA, DaB	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
DbA, Dd	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
For Urban land part of Dd, see Urban land.									
Dc	Fair	Good	Poor	Poor	Fair	Good	Fair	Poor	Fair.
Devol: DvB	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Enterprise:									
EnA, EnB, EnC	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EnD	Fair	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EnE	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Fluvents. Mapped only in a complex with Mangum soils. Too variable to be rated.									
Frankirk: FrA, FrB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Grandfield: GfB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hardeman: HaB, HaC	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hollister: HoA	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Kamay: KaA, KaB, KcB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
For Urban land part of KcB, see Urban land.									
Kirkland: KrA, KrB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Knoco	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Mapped only in complex with Owens soils.									
Latom: LaE, LcE	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
For Owens part of LaE, see Owens series. For Urban land part of LcE, see Urban land.									
Lincoln:									
Ln	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Lw	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

TABLE 7.—*Suitability of the soils for wildlife habitat elements and kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow-water development	Openland	Rangeland	Wetland
Mangum:									
Ma, Mf	Good	Good	Good	Good	Poor	Good	Good	Good	Fair.
For Urban land part of Mf, see Urban land.									
Mc	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Me. For Fluvents part, see Fluvents. Too variable to be rated.									
Mg	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
Motley: MoA, MoB, MoC	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Oben: ObC	Poor	Poor	Fair	Poor	Poor	Very poor.	Poor	Poor	Very poor.
Oil wasteland: Oe. Too variable to be rated.									
Owens: OsF, OwE	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
For Knoco part of OwE, see Knoco series.									
Port: Po	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Renfrow: ReA, ReB, RfB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
For Urban land part of RfB, see Urban land.									
Rotan: RoA, RoB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Tillman:									
TcA, TcB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
TfB	Fair	Good	Very poor.	Very poor.	Fair	Fair	Poor	Very poor.	Fair.
For Deandale part, see Deandale series.									
Tipton: ToA, Tu	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
For Urban land part of Tu, see Urban land.									
Tivoli: Tv	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Urban land: Ua. Too variable to be rated.									
Vernon:									
VcB, VcC	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
VoD	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
For Owens part, see Owens series.									
Waurika: WaA	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Winters:									
WnA, WnB, WnC, WuB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
For Urban land part of WuB, see Urban land.									
Ws	Fair	Good	Poor	Poor	Fair	Good	Fair	Poor	Fair.
Yahola: Ya	Poor	Fair	Fair	Good	Poor	Very poor.	Fair	Fair	Very poor.
For Yomont part, see Yomont series.									
Yomont: Yo	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Asa [1]	Fine-silty, mixed, thermic	Fluventic Haplustolls	Mollisols.
Bluegrove	Fine, mixed, thermic	Udic Haplustalfs	Alfisols.
Clairemont	Fine-silty, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Cobb	Fine-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Deandale	Fine, mixed, thermic	Typic Natrustolls	Mollisols.
Devol	Coarse-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Enterprise	Coarse-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Frankirk	Fine, mixed, thermic	Udic Argiustolls	Mollisols.
Grandfield	Fine-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Hardeman	Coarse-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Hollister	Fine, mixed, thermic	Pachic Paleustolls	Mollisols.
Kamay	Fine, mixed, thermic	Typic Paleustalfs	Alfisols.
Kirkland [2]	Fine, mixed, thermic	Udertic Paleustolls	Mollisols.
Knoco	Clayey, mixed (calcareous), thermic, shallow	Ustic Torriorthents	Entisols.
Latom	Loamy, mixed (calcareous), thermic	Lithic Ustic Torriorthents	Entisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Mangum	Fine, mixed (calcareous), thermic	Vertic Ustifluvents	Entisols.
Motley	Fine-loamy, mixed, thermic	Udic Paleustolls	Mollisols.
Oben	Loamy, mixed, thermic, shallow	Udic Haplustalfs	Alfisols.
Owens	Clayey, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Port	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols.
Renfrow	Fine, mixed, thermic	Udertic Paleustolls	Mollisols.
Rotan	Fine, mixed, thermic	Pachic Paleustolls	Mollisols.
Tillman	Fine, mixed, thermic	Typic Paleustolls	Mollisols.
Tipton	Fine-loamy, mixed, thermic	Pachic Argiustolls	Mollisols.
Tivoli [3]	Mixed, thermic	Typic Ustipsamments	Entisols.
Vernon	Fine, mixed, thermic	Typic Ustochrepts	Inceptisols.
Waurika	Fine, montmorillonitic, thermic	Typic Argialbolls	Mollisols.
Winters	Fine, mixed, thermic	Udic Paleustalfs	Alfisols.
Yahola	Coarse-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Yomont	Coarse-silty, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.

[1] These soils are taxadjuncts because they are drier for longer periods of time than is typical for the series. This difference does not affect their use, management, or behavior.
[2] Some of these soils are taxadjuncts because they have carbonates at a depth of less than 28 inches. This difference does not affect their use, management, or behavior.
[3] This soil is a taxadjunct because it is calcareous to the surface layer. This difference does not affect its use, management, or behavior.

TABLE 9.—*Temperature and precipitation data*

[Data from Wichita Falls; elevation 994 feet]

Month	Temperature					Precipitation			Precipitation—Continued											
	Average daily maximum [1]	Average monthly highest [2]	Average daily minimum	Average monthly lowest	Average total	Probability of receiving—			Probability of receiving—Continued					Average number of days with—			Snow or sleet			
						0 or a trace	0.50 inch or more	1 inch or more	2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.10 inch or more [3]	0.50 inch or more [4]	1 inch or more [5]	Average total [6]	Monthly maximum [7]	Greatest depth [8]
	°F	°F	°F	°F	*Inches*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*				*Inches*	*Inches*	*Inches*
January	53.4	76.9	31.6	10.9	1.12	[9]<1	68	48	18	8	4	<1	<1	2	1	([10])	1.8	11.9	7
February	58.4	79.8	35.1	17.7	1.38	1	75	50	28	15	5	2	1	3	1	([10])	1.8	8.6	5
March	66.4	86.5	41.1	21.4	1.54	6	79	58	28	15	5	2	<1	3	1	1	1.0	6.5	5
April	76.4	92.4	51.5	34.4	2.53	<1	95	82	54	30	19	10	5	5	2	1	([11])	([11])	([11])
May	83.7	97.1	60.6	45.7	4.60	<1	99	95	80	70	50	35	25	5	3	1	0.0	0.0	0
June	93.2	101.6	70.3	58.1	3.20	<1	95	83	65	45	29	19	15	5	2	1	0.0	0.0	0
July	97.9	104.8	73.3	64.2	1.97	2	81	68	38	25	15	9	4	3	1	1	0.0	0.0	0
August	98.3	106.7	73.1	61.5	1.79	8	74	58	50	20	15	8	5	5	1	([10])	0.0	0.0	0
September	89.9	101.2	64.9	49.9	2.33	10	79	68	45	30	20	14	8	5	2	1	0.0	0.0	0
October	78.8	92.7	53.9	36.8	2.87	4	83	83	50	31	20	15	10	4	2	1	([11])	([11])	0
November	64.9	82.6	40.0	24.7	1.42	10	65	50	25	13	6	3	2	2	1	([10])	0.2	3.9	4
December	55.9	76.8	33.2	17.0	1.45	4	70	50	28	15	8	4	2	3	1	([10])	0.9	5.4	4
Year	76.5	91.6	52.4	36.9	26.20									45	18	7	5.7	11.9	7

[1] Climatological standard normals for 1931–60.
[2] For the period 1941–70.
[3] Average length of record, 17 years.
[4] Average length of record, 20 years.
[5] Average length of record, 20 years.
[6] Average length of record, 27 years.
[7] Average length of record, 27 years.
[8] Average length of record, 15 years.
[9] The symbol < means less than.
[10] Less than one-half day.
[11] Trace; an amount too small to measure.

NRCS Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

OKLAHOMA

COUNTY

COUNTY

WILBARGER

CLAY

BAYLOR COUNTY

ARCHER COUNTY

34°10′

34°00′

98°50′

98°40′

98°30′

RED RIVER

MISSOURI KANSAS TEXAS

Haynesville

Electra

Burkburnett

Iowa Park

Pleasant Valley

WICHITA FALLS

Kadane Corner

NORTH FORK BUFFALO CREEK RESERVOIR

LAKE IOWA PARK

LAKE WICHITA

FORT WORTH AND DENVER

CALL FIELD

NORTH SIDE CANAL

Adams Creek

China Creek

Cole Creek

Wildhorse Creek

Gilbert Creek

North Fork Buffalo Creek

South Fork Buffalo Creek

West Fork

Middle Fork

East Fork

Pond Creek

Bear Creek

Wichita River

Holiday Creek

Beaver Creek

SOIL ASSOCIATIONS

1 Kamay-Bluegrove-Deandale association: Nearly level to gently sloping, deep and moderately deep, very slowly permeable to moderately slowly permeable soils; on uplands

2 Tillman-Vernon association: Nearly level to sloping, deep and moderately deep, slowly permeable and very slowly permeable soils; on uplands

3 Clairemont-Mangum association: Nearly level to steep, deep, moderately permeable to very slowly permeable soils; on bottom lands

4 Motley-Frankirk association: Nearly level to gently sloping, deep, moderately permeable and moderately slowly permeable soils; on uplands

5 Enterprise association: Nearly level to moderately steep, deep, moderately rapidly permeable soils; on uplands

6 Winters-Deandale association: Nearly level to gently sloping, deep, moderately slowly permeable to very slowly permeable soils; on uplands

Compiled 1975

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

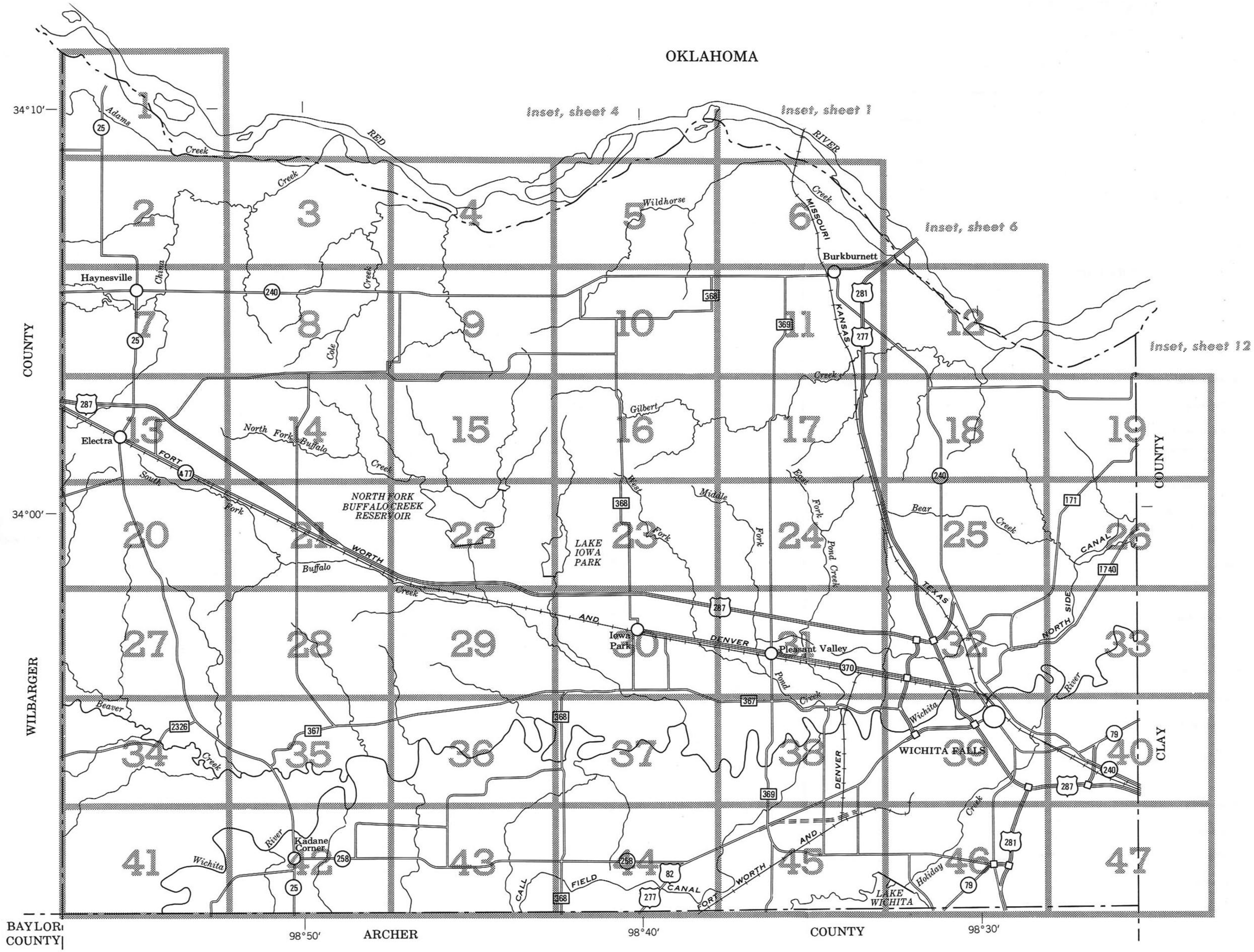
GENERAL SOIL MAP

WICHITA COUNTY, TEXAS

Scale 1:190,080

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
WICHITA COUNTY, TEXAS

Scale 1:190,080

1 0 1 2 3 4 Miles

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals or ditches, singleline unclassified

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The third letter, always a capital, shows the slope. Most symbols without slope letters are those of nearly level soils but some are for soils that have a considerable range in slope. The symbol (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be reliably estimated.

SYMBOL	NAME
As	Asa silty clay loam, occasionally flooded
Aw	Asa and Port soils, frequently flooded
BeB	Bluegrove loam, 1 to 3 percent slopes
BeC	Bluegrove loam, 3 to 5 percent slopes
BuB	Bluegrove-Urban land complex, 1 to 3 percent slopes
Ca	Clairemont silt loam
Cb	Clairemont-Urban land complex
Cc	Clairemont soils, wet
CoB	Cobb fine sandy loam, 1 to 3 percent slopes (W)
DaA	Deandale silt loam, 0 to 1 percent slopes
DaB	Deandale silt loam, 1 to 3 percent slopes
DbA	Deandale silt loam, loamy substratum, 0 to 1 percent slopes
Dc	Deandale silt loam, wet
Dd	Deandale-Urban land complex
DvB	Devol loamy fine sand, 0 to 3 percent slopes (W)
EnA	Enterprise very fine sandy loam, 0 to 1 percent slopes
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes
EnC	Enterprise very fine sandy loam, 3 to 5 percent slopes
EnD	Enterprise very fine sandy loam, 5 to 8 percent slopes
EnE	Enterprise very fine sandy loam, 8 to 20 percent slopes
FrA	Frankirk loam, 0 to 1 percent slopes
FrB	Frankirk loam, 1 to 3 percent slopes
GfB	Grandfield fine sandy loam, 1 to 3 percent slopes (W)
HaB	Hardeman fine sandy loam, 1 to 3 percent slopes (W)
HaC	Hardeman fine sandy loam, 3 to 5 percent slopes (W)
HoA	Hollister clay loam, 0 to 1 percent slopes
KaA	Kamay silt loam, 0 to 1 percent slopes
KaB	Kamay silt loam, 1 to 3 percent slopes
KcB	Kamay-Urban land complex, 0 to 3 percent slopes
KrA	Kirkland silt loam, 0 to 1 percent slopes
KrB	Kirkland silt loam, 1 to 3 percent slopes
LaE	Latom-Owens complex, 5 to 20 percent slopes
LcE	Latom-Urban land complex, 5 to 20 percent slopes
Ln	Lincoln fine sandy loam
Lw	Lincoln soils, frequently flooded
Ma	Mangum silty clay loam
Mc	Mangum clay
Me	Mangum-Fluvents complex, severely eroded
Mf	Mangum-Urban land complex
Mg	Mangum soils, wet
MoA	Motley loam, 0 to 1 percent slopes
MoB	Motley loam, 1 to 3 percent slopes
MoC	Motley loam, 3 to 5 percent slopes
ObC	Oben fine sandy loam, 1 to 5 percent slopes (W)
Oe	Oil wasteland
OsF	Owens stony clay, 5 to 30 percent slopes
OwE	Owens-Knoco complex, 3 to 15 percent slopes
Po	Port silt loam
ReA	Renfrow loam, 0 to 1 percent slopes
ReB	Renfrow loam, 1 to 3 percent slopes
RfB	Renfrow-Urban land complex, 0 to 3 percent slopes
RoA	Rotan loam, 0 to 1 percent slopes
RoB	Rotan loam, 1 to 3 percent slopes
TcA	Tillman clay loam, 0 to 1 percent slopes
TcB	Tillman clay loam, 1 to 3 percent slopes
TfB	Tillman and Deandale soils, saline, 0 to 3 percent slopes
ToA	Tipton loam, 0 to 1 percent slopes
Tu	Tipton-Urban land complex
Tv	Tivoli fine sand (W)
Ua	Urban land
VcB	Vernon clay loam, 1 to 3 percent slopes
VcC	Vernon clay loam, 3 to 5 percent slopes
VoD	Vernon and Owens soils, 3 to 8 percent slopes
WaA	Waurika silt loam, 0 to 1 percent slopes
WnA	Winters loam, 0 to 1 percent slopes
WnB	Winters loam, 1 to 3 percent slopes
WnC	Winters loam, 3 to 5 percent slopes
Ws	Winters loam, wet
WuB	Winters-Urban land complex, 0 to 3 percent slopes
Ya	Yahola and Yomont soils, frequently flooded
Yo	Yomont very fine sandy loam

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 565 000 FEET

920 000 FEET

1 660 000 FEET

909 000 FEET

905 000 FEET

1 665 000 FEET

1 595 000 FEET

RED RIVER

TILLMAN COUNTY OKLAHOMA

COTTON COUNTY OKLA

APPROX BDY

APPROXIMATE BOUNDARY

WILBARGER COUNTY

Adams Creek

water

(Joins inset, sheet 4)

(Joins sheet 6)

4000 AND 5000-FOOT GRID TICKS

N

1 Mile
5000 Feet

WICHITA COUNTY, TEXAS — SHEET NUMBER 2

2

N

(Joins sheet 1)

1 585 000 FEET

905 000 FEET

APPROX BDY

WILBARGER COUNTY

1 Mile

5 000 Feet

0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 1 5000

890 000 FEET

1 560 000 FEET

(Joins sheet 7)

(Joins sheet 3)

China Creek

Mt Carmel Church

GRAVEL PIT

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3

N

1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000

(4)

N

1 Mile
5 000 Feet

1 630 000 FEET

1 655 000 FEET

910 000 FEET

905 000 FEET

900 000 FEET

890 000 FEET

1 650 000 FEET

1 610 000 FEET

RED RIVER

Creek

China Creek

Cole Creek

Cavalry Creek

Tenth Creek

APPROXIMATE BOUNDARY

TILLMAN COUNTY OKLAHOMA

(Joins sheet 3)

(Joins inset, sheet 1)

(Joins sheet 5)

(Joins sheet 9)

Lw Tv Yo Ln Ca EnA EnB EnC EnD EnE HaB HaC Cc ToA MoB MoC OwE

1

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 635 000 FEET

1 900 000 FEET

(Joins inset, sheet 4)

(Joins sheet 4)

(Joins sheet 6)

1 890 000 FEET

WnB

(Joins sheet 10)

BeC

1 655 000 FEET

RIVER

RED

TILLMAN COUNTY

OKLAHOMA

APPROXIMATE BOUNDARY

Wildhorse Creek

Boehmer Camp

GRAVEL PIT

Lw Tv Mc Ca OwE EnE EnD EnC EnB EnA Oe LaE ToA VcC MoC MoB Aw FrB DaB DaA BeC BeB KaB KaA ObC RoB RoA

N

1 Mile

5,000 Feet

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

N

1 Mile
5 000 Feet
0
0
¼
1 000
½
2 000
¾
3 000
1
4 000
5 000

(Joins inset, sheet 1)

1 680 000 FEET

890 000 FEET

RED RIVER

APPROXIMATE BOUNDARY

Wildhorse Creek

MISSOURI

KANSAS

TEXAS

OKLAHOMA

COTTON COUNTY

BURKBURNETT

(Joins sheet 5)

(Joins sheet 11)

1 660 000 FEET

(Joins inset)

1 686 000 FEET

(Joins lower right)

888 000 FEET

1 683 000 FEET

(Joins sheet 12)

2000 AND 3000-FOOT GRID TICKS

277
281

267

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WICHITA COUNTY, TEXAS — SHEET NUMBER 7

1 560 000 FEET

(Joins sheet 2)

885 000 FEET

WILBARGER COUNTY

Haynesville

Creek

China

Creek

(Joins sheet 8)

875 000 FEET

1 580 000 FEET

(Joins sheet 13)

7

N

1 Mile

5000 Feet

WICHITA COUNTY, TEXAS — SHEET NUMBER 8

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WICHITA COUNTY, TEXAS — SHEET NUMBER 9

1 610 000 FEET

885 000 FEET

(Joins sheet 8)

(Joins sheet 4)

(Joins sheet 10)

(Joins sheet 15)

875 000 FEET

1 630 000 FEET

9

N

1 Mile

5 000 Feet

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

10

N

(Joins sheet 5)

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 16)

1 655 000 FEET

1 835 000 FEET

1 Mile

5000 Feet

0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 1 5000

Trinity Church

CLARA CEMETERY

Wildhorse Creek

1813 368 240 2345

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

12

N

1 Mile
5000 Feet

1 705 000 FEET

1 720 000 FEET

875 000 FEET

885 000 FEET

871 000 FEET

1 710 000 FEET

1 685 000 FEET

(Joins inset, sheet 6)

(Joins lower right)

(Joins sheet 19)

(Joins sheet 11)

(Joins sheet 18)

(Joins inset)

4000 AND 5000-FOOT GRID TICKS

RED RIVER

COTTON COUNTY

OKLAHOMA

CLAY COUNTY

APPROXIMATE BOUNDARY

Gilbert Creek

EnA EnB EnC EnD EnE HaB HaC Lw MoA MoB MoC Po ToA VoD Oe Aw Ln

WICHITA COUNTY, TEXAS — SHEET NUMBER 13

(13)

N

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 Mile
5000 Feet
1 ½ ¼ ¼ 0
5000 4000 3000 2000 1000 0

14

N

1 Mile
5000 Feet

(Joins sheet 8)

1 605 000 FEET

870 000 FEET

860 000 FEET

1 585 000 FEET

(Joins sheet 21)

(Joins sheet 13)

(Joins sheet 15)

North Fork Buffalo Creek

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WICHITA COUNTY, TEXAS — SHEET NUMBER 15

15

N

1 610 000 FEET

1 870 000 FEET

1 860 000 FEET

1 630 000 FEET

(Joins sheet 9)

(Joins sheet 14)

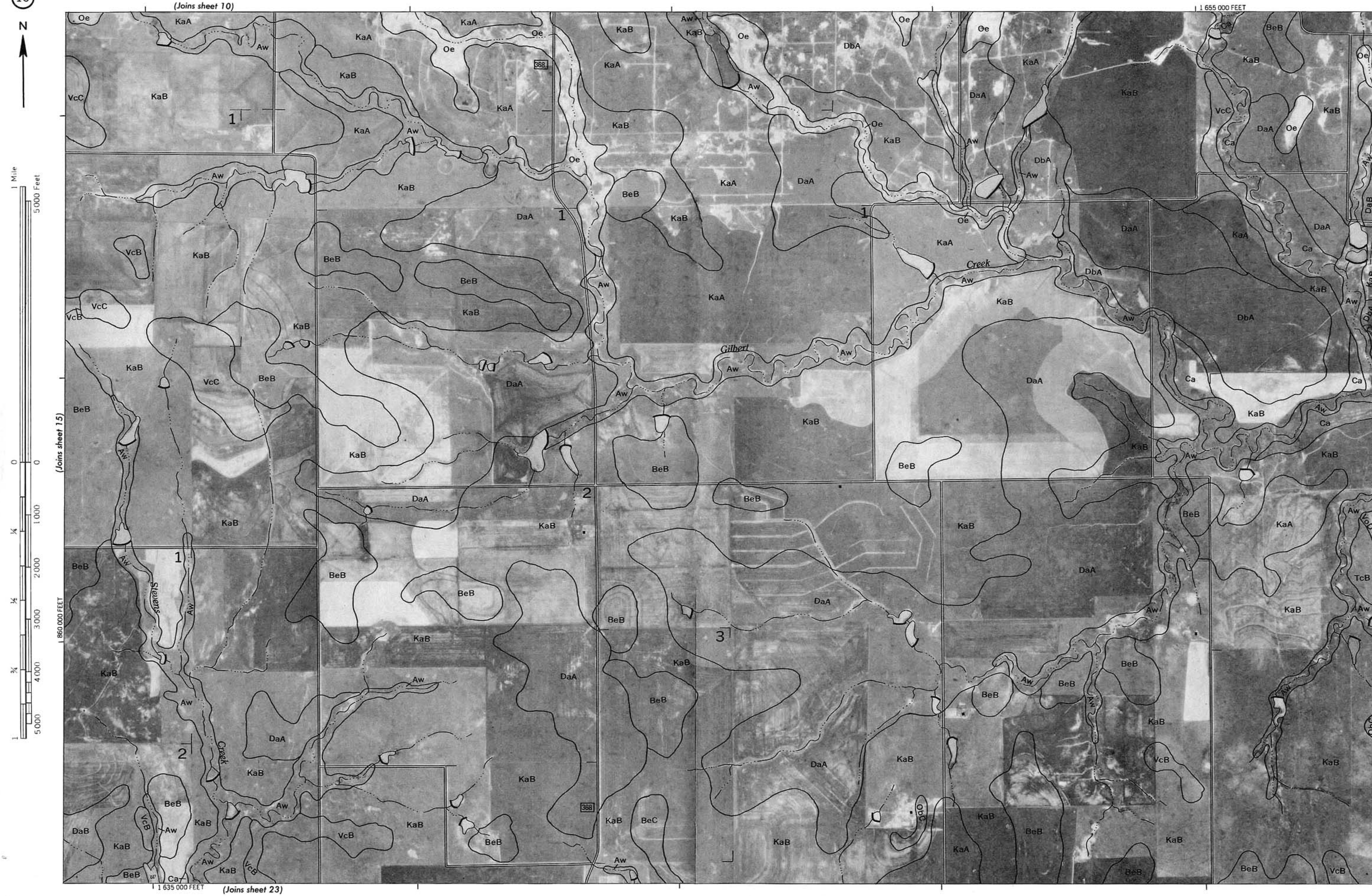
(Joins sheet 16)

(Joins sheet 22)

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 Mile
5 000 Feet

WICHITA COUNTY, TEXAS — SHEET NUMBER 16



This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 660 000 FEET

870 000 FEET

(Joins sheet 11)

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 24)

1 680 000 FEET

855 000 FEET

Gilbert Creek

MISSOURI

KANSAS

TEXAS

369

277
281

17

N

1 Mile

5 000 Feet

(18)

N

1 Mile
5000 Feet

0 0
¼ 1 000
½ 2 000
¾ 3 000
1 4 000
5 000

(Joins sheet 12)

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 25)

1 705 000 FEET

870 000 FEET

1 855 000 FEET

1 685 000 FEET

COTTON CO
OKLA

Gilbert Creek

SHEPPARD AIR FORCE BASE

1177

240

1 710 000 FEET

870 000 FEET

(Joins inset, sheet 12)

(Joins sheet 18)

(Joins sheet 26)

855 000 FEET

1 730 000 FEET

CLAY COUNTY

GRAVEL PIT

G.P.

19

N

1 Mile

5000 Feet

WICHITA COUNTY, TEXAS — SHEET NUMBER 20

N

1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
0
1000
2000
3000
4000
5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 585 000 FEET

855 000 FEET

(Joins sheet 14)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 28)

1 605 000 FEET

840 000 FEET

21

N

1 Mile

5000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

N

1 Mile
5000 Feet
0 1/4 1/2 3/4 1

(Joins sheet 15)

FrA DbA

1 630 000 FEET

855 000 FEET

(Joins sheet 21)

(Joins sheet 23)

NORTH FORK BUFFALO CREEK RESERVOIR

LAKE IOWA PARK

Buffalo Creek

North Fork Buffalo Creek

South Fork Buffalo Creek

FORT WORTH AND DENVER

287

840 000 FEET

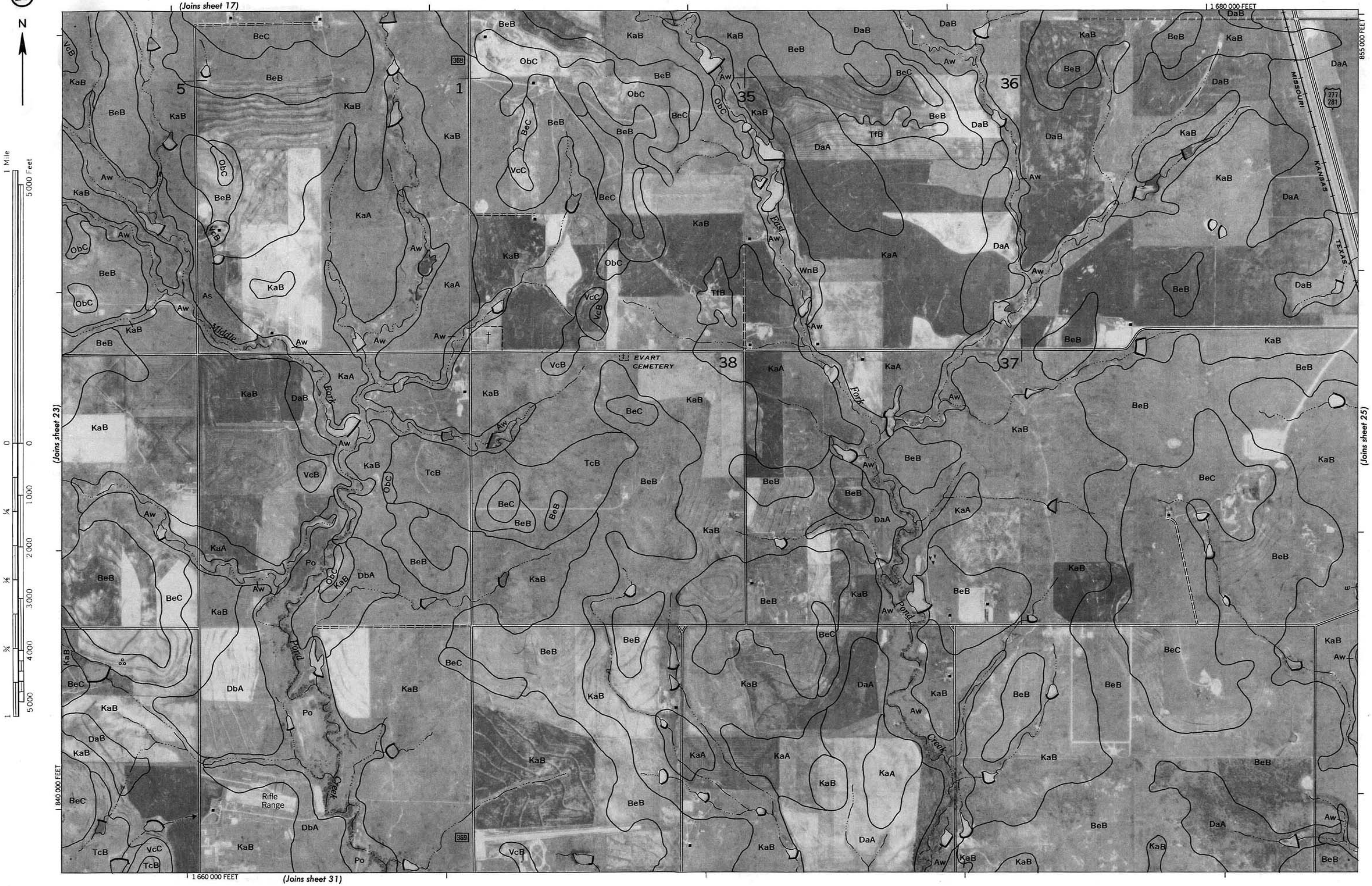
1 610 000 FEET

(Joins sheet 29)

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 16)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)

WICHITA COUNTY, TEXAS — SHEET NUMBER 24



This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 685 000 FEET

855 000 FEET

(Joins sheet 18)

(Joins sheet 24)

(Joins sheet 32)

1 705 000 FEET

840 000 FEET

SHEPPARD AIR FORCE BASE

MISSOURI

KANSAS

TEXAS

DUAL

Plum Creek

Bear Creek

25

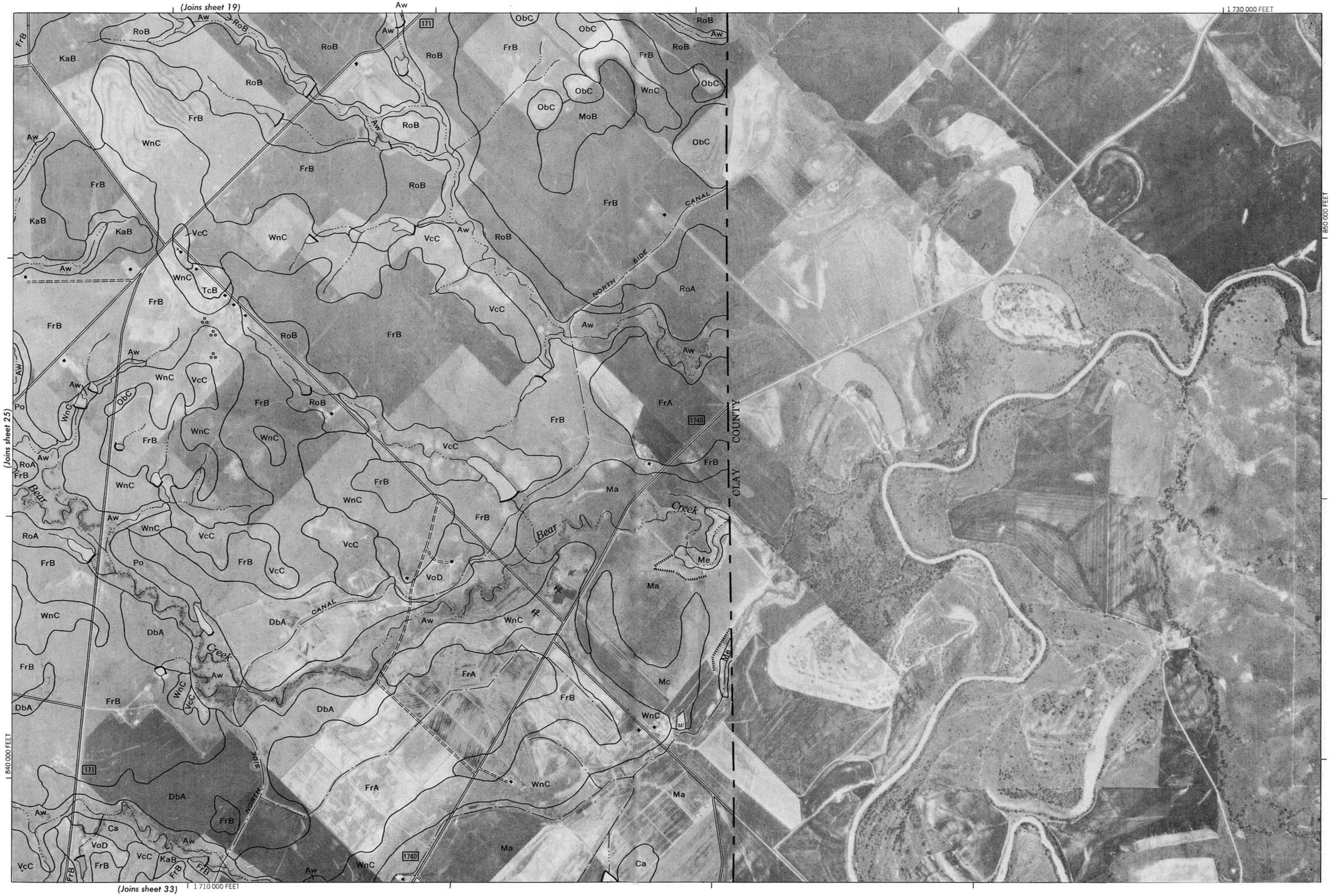
N

1 Mile

5000 Feet

WICHITA COUNTY, TEXAS — SHEET NUMBER 26

26



N

1 Mile
5000 Feet
0 0
¼ 1000
2000
½ 3000
¾ 4000
1 5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 560 000 FEET

840 000 FEET

(Joins sheet 20)

(Joins sheet 28)

1 580 000 FEET

825 000 FEET

(Joins sheet 34)

WILBARGER COUNTY

Bluff Creek

Rough Creek

Turkey Creek

Bluff Creek

Creek

Creek

Creek

Creek

25

26

24

34

27

N

1 Mile

5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

N

1 Mile
5 000 Feet
0
0
¼
1 000
½
2 000
¾
3 000
1
4 000
5 000

(Joins sheet 21)

1 605 000 FEET

835 000 FEET

(Joins sheet 27)

(Joins sheet 29)

825 000 FEET

1 585 000 FEET

(Joins sheet 35)

Horse Creek

Wolf Creek

2384

35

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 28)
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)

1 610 000 FEET
835 000 FEET
825 000 FEET
1 630 000 FEET

Fort Worth and Denver
North Fork
South Fork
Horse Creek
Stevens Creek
Buffalo Creek
Deep Flat Creek
287
367

29
N

1 Mile
5 000 Feet

WICHITA COUNTY, TEXAS — SHEET NUMBER 30

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

32

N

1 Mile
5000 Feet
0
0
¼
1 000
½
2000
¾
3000
1
4000
5000

(Joins sheet 31)

(Joins sheet 25)

1 705 000 FEET

1 835 000 FEET

(Joins sheet 33)

825 000 FEET

(Joins sheet 39)

1 685 000 FEET

SHEPPARD AIR FORCE BASE

MUNICIPAL AIRPORT

WICHITA FALLS
(county seat)

Plum Creek

MISSOURI-KANSAS-TEXAS

FORT WORTH AND DENVER

NORTH SIDE CANAL

WICHITA RIVER

BeB BeC BuB DaA DaB FrA FrB KaB KcB KcG Ma Mc Mf Mg ObC Ua VcC VoD WnA WnB WnC WuB Ya Yo

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

(Joins sheet 26)

1 710 000 FEET

835 000 FEET

(Joins sheet 32)

(Joins sheet 40)

1 730 000 FEET

825 000 FEET

1 Mile

5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

Aw VcC VoD FrA WnC FrB KaB BeB Ma Ca Mc Me Cc Yo Ya WnB VoD TcB BeC OwE As ReB KrB WaA

171 1740

CANAL

G.P.

water

NORTH SIDE

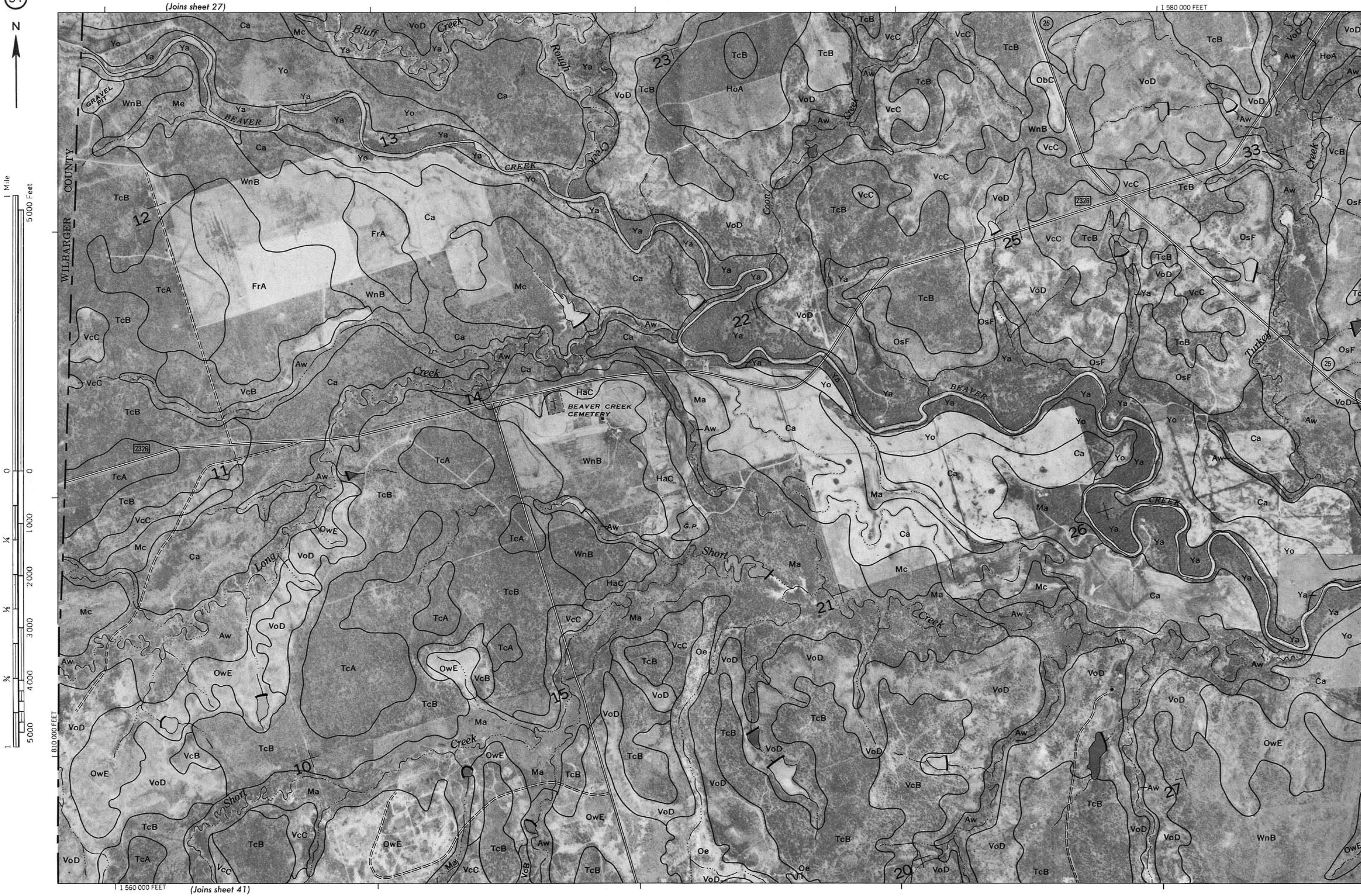
WICHITA RIVER

COUNTY LINE

CLAY

(34)

WICHITA COUNTY, TEXAS — SHEET NUMBER 34



This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 585 000 FEET

820 000 FEET

(Joins sheet 28)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 42)

1 605 000 FEET

810 000 FEET

35

N

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

N

(Joins sheet 29)

1 630 000 FEET

820 000 FEET

(Joins sheet 37)

(Joins sheet 35)

810 000 FEET

1 610 000 FEET

(Joins sheet 43)

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WICHITA COUNTY, TEXAS — SHEET NUMBER 37

37

N

1 Mile
5000 Feet

1 0 ¼ ½ ¾ 1
5 000 4 000 3 000 2 000 1 000 0

N

(Joins sheet 31)

1 680 000 FEET

1 820 000 FEET

(Joins sheet 39)

(Joins sheet 37)

1 810 000 FEET

1 660 000 FEET

(Joins sheet 45)

1 Mile

5000 Feet

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

WICHITA FALLS
(county seat)

RIVER

Creek

Pond

GRAVEL PIT

DENVER AND FORT WORTH

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 685 000 FEET

820 000 FEET

(Joins sheet 32)

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 46)

1 705 000 FEET

810 000 FEET

39

N

1 Mile

5 000 Feet

WICHITA FALLS
(county seat)

RIVERSIDE CEMETERY

SACRED HEART CEMETERY

WICHITA RIVER

Holliday Creek

FORT WORTH & DENVER CITY

MISSOURI KANSAS TEXAS

DUAL

water

Ca Cb Cc Dd DaA DbA KaB KcB LaE LcE Ma Mc Me Mf OwE RfB ReB SeB Tu Ua WnA WnB WuB Ya Yo BeB BuB VcC

(40)

N

(Joins sheet 33)

1 730 000 FEET

1 820 000 FEET

1 810 000 FEET

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

¼ ½ ¾ 1

(Joins sheet 39)

(Joins sheet 47)

Holliday

WICHITA RIVER

water

FORT WORTH

MISSOURI AND KANSAS TEXAS DENVER

WICHITA FALLS
(county seat)

GRAVEL PIT

CLAY COUNTY

Yo Ya Ma Ca Mc Ua OwE LaE KrB ReB BeB WaA VoD As Aw WnA WnB WuB DbA Tu RfB BuB ReA VcC ObC KrA

79 240 82 287

1 560 000 FEET

1 805 000 FEET

1 795 000 FEET

1 580 000 FEET

(Joins sheet 34)

(Joins sheet 42)

WILBARGER COUNTY

ARCHER COUNTY

Short Creek

WICHITA RIVER

41

N

1 Mile

5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

N

1 Mile

5000 Feet

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

(Joins sheet 35)

(Joins sheet 41)

(Joins sheet 43)

1 605 000 FEET

805 000 FEET

795 000 FEET

1 585 000 FEET

Kadane Corner

Kamay

GRAVEL PIT

WICHITA RIVER

Wichita Creek

Turkey Creek

Camp Creek

S SIDE CANAL

ARCHER COUNTY

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 42)

(Joins sheet 36)

(Joins sheet 44)

1 610 000 FEET

805 000 FEET

795 000 FEET

1 630 000 FEET

ARCHER COUNTY

Valley View

Creek

NORTH SIDE CANAL

SOUTH SIDE CANAL

Antelope FIELD CANAL

1206

2206

258

43

N

1 Mile

5000 Feet

0 0

1/4 1000

1/2 2000 3000

3/4 4000

1 5000

(44)

N

1 Mile
5000 Feet
0
¼ 1000
½ 2000
¾ 3000
1 4000
5000

(Joins sheet 37)

(Joins sheet 43)

(Joins sheet 45)

ARCHER COUNTY

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 44)

(Joins sheet 38)

(Joins sheet 46)

1 660 000 FEET

805 000 FEET

790 000 FEET

1 680 000 FEET

WICHITA FALLS
(county seat)

US HWY NO 277 UNDER CONSTRUCTION

LAKE WICHITA

ARCHER COUNTY

LAKEVIEW CEMETERY

CRESTVIEW CEMETERY

CANAL

FIELD

CALL

DENVER

AND

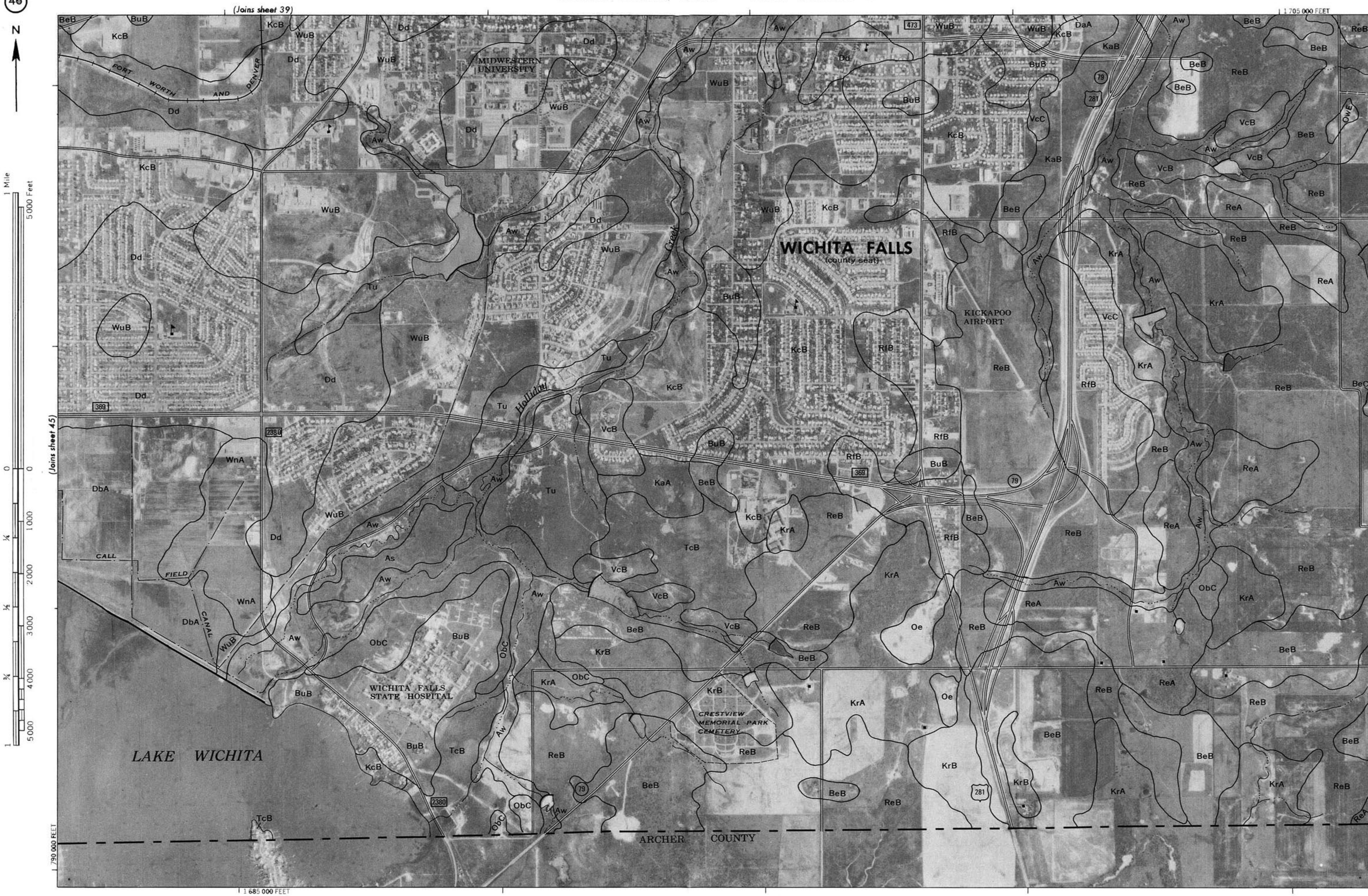
FORT WORTH

45

N

1 Mile
5000 Feet
0 0
¼ 1000
2000
½ 3000
4000
¾ 5000
1

WICHITA COUNTY, TEXAS — SHEET NUMBER 46



This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 40)

(Joins sheet 46)

1 710 000 FEET

805 000 FEET

1 730 000 FEET

790 000 FEET

ARCHER COUNTY

CLAY COUNTY

47

N

1 Mile

5000 Feet

1 0 ¼ ½ ¾ 1

5000 4000 3000 2000 1000 0

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.